ACCIDENTS IN MINES.*

II.

Falls of Roof and Sides.

(*Continued from page 208.*)

Since the issue of our Preliminary Report† no further evidence has been taken by us as to the causes of falls of roof and sides in mines, and as to the means of preventing accidents arising therefrom.

From the statistics given in evidence by Mr. Dickinson, it appears that the deaths caused in the coal mines of Great Britain by falls of roof and sides since 1850 were as follows, *i. e.*: 10 years ending 1860—37.6 per cent. of the total deaths from accidents of all descriptions; 10 years ending 1870—39.1 per cent. of the total deaths from accidents of all descriptions; 10 years ending 1880—39.7 per cent. of the total deaths from accidents of all descriptions; and during the last two years, viz., 1882 and 1883, they were respectively 41.5 and 44.5 per cent. It would therefore appear that the deaths from falls form a larger proportion of the total deaths in mines at present than they did thirty years ago. Taking, however, into consideration the greater number of persons now employed in our mines, whose lives are daily and hourly exposed to this risk of accident, and also the increased quantity of minerals raised, it will be found that a great improvement has taken place in the death rate from falls, per 1,000 persons, employed during the last few years.

The annual average death rate from falls of roof and sides during the 10 years ending 1860, was 1.531 per 1,000 persons employed; the 10 years ending 1870, was 1.304 per 1,000 persons employed; the 10 years ending 1880, was 0.935 per 1,000 persons employed or a reduction of 40 per cent. on the average death rate per 1,000 persons employed compared with the 10 years ending 1860.

Taking the period since the Mines Regulation Act came into force, *i. e.*, the 12 years ending 1884, it will be further seen that there is a marked, although fluctuating, improvement in regard to the number of deaths from falls in mines, comprised under the Coal Mines Act:

Years.	Tons of Minerals raised.	Number of persons employed.	Deaths.
1873	143,041,246	514,149	491
1884	174,872,759	520,376	482

These figures show that in 1873 a life was lost by this class of accident for every 291,326 tons of minerals raised, while in 1884, 362,806 tons were raised per life lost, being an improvement of about 20 per cent.

The evidence given by Your Majesty's Inspectors of Mines for the several districts, as well as of mining engineers having the conduct of collieries in the different coal fields (*vide* Preliminary Report), indicates considerable differences of opinion as to the best system and arrangements for ensuring the proper support of the roof and sides of the mines.

Some advocate the north of England system, as practised in Northumberland and Durham, where the setting of timber in the face is performed by deputies, while others have found by experience under different circumstances that the system of requiring the hewers to put up all necessary props in their working places affords greater protection where the seams are thick and the roof is bad, conditions which generally prevail in Lancashire and in the South Wales steam collieries.

The whole of the evidence tends to show that it would be impossible to lay down any general rule for the timbering of mines which would be satisfactory under all circumstances, and practically applicable to the whole of the mining districts.

The conditions under which the various descriptions of mines have to be worked, the nature of the mineral, the character of the roof and floor of the deposit, the inclination at which the seams or beds of coal or other minerals are found, vary so much in different districts, and in different seams of the same district, and even in the same seam of a colliery, that to lay down any definite rule would be wholly impracticable. In some districts the slips or cleavage in the seams of coal, as well as "Backs," extend up into the roof, which is sometimes also interstratified with irregular ball of ironstone. All these causes tend to break the continuity of the strata, and to render the removal of the coal which in such cases supports the roof, far more dangerous, thus necessitating greater care on the part of each collier or hewer. In addition to the danger from the slips running up into the roof, it often occurs, in some districts where seams of coal are comparatively near together, that great pressure or thrust has to be guarded against, in some cases, from the sides, in other cases from the heaving of the thill, or bottom. When these conditions occur, special care and skill in timbering are required.

With such a variety of circumstances and conditions, it is difficult even with the statistics kept as to the result of the several systems of timbering in the different coal fields, to institute anything like a trustworthy comparison, more especially as previous to the Mines Regulation Act of 1872, much greater care was taken in some districts than others. While we are unable for the reasons mentioned to specify which system of timbering is best, the experience of the last ten years, of the improved and additional supervision secured under the Mines Act, renders it certain that much may be done towards reducing the number of accidents and deaths from falls by attention to the following points:

A. The maintenance of ample supplies of timber in localities convenient to the workmen.

B. The proper training of each miner to the best mode of timbering and otherwise protecting his working place.

C. The exercise of increased care on the part of the workmen in watching the roof, sides, and face, protecting themselves in time.

D. The introduction, as far as possible, of arrangements with the workmen, which will make it their interest not to avoid the labor of putting up the necessary timber, cog walls, buildings, or nogs for their proper protection.

E. The employment of special timbermen or deputies for the timbering of mainways, and also for the repairing as well as drawing of timber.

F. Preventing timber being left in the goaf of long wall workings which would have the effect of breaking the roof.

G. Driving the working places as rapidly as possible, by shifts of an ample number of workmen in each face, and so reducing the risk of falls and exposing the least number of men to danger at any one time.

Much has been expected by some mining engineers, from the employment of other material than timber in the propping and securing of mines. Punch-props of cast iron, of various patterns, to be surmounted in use by a lid of wood, were introduced nearly half a century ago in Yorkshire and the north, and are still occasionally met with. Some of them have been made in two pieces, with a ring of wrought-iron over the joint, by lifting which their removal may be assisted. But it does not appear that the advantages to be gained by the use of this material are such as to greatly extend its application. About twenty years ago the screw prop (*vis bottle*) introduced in the collieries of Anzin, was put forward as desirable for convenience and security. It consists of a short prop of hardwood bound with iron bands, and having in the center a strong iron screw with square thread. By means of a nut on the top of the block, turned by a long spanner, the screw rises and is forcibly jammed against the roof. When the face of the work is duly advanced the unscrewing of the bar admits of the easy removal of the prop to another position. Again, in lieu of frames or sets of timber by which the mainways are fortified, wrought-iron has been extensively tried in many of the Continental and in some of the Welsh collieries. Frames of rolled iron, with a section very similar to some of the bars of ordinary railways, are placed at short intervals, usually in an elliptical form, in one or two pieces, more rarely, for double road-ways, in four pieces, with their joints secured by fish-plates and screw bolts. The space between the frames is more or less guarded by "lagging" or bars, generally of wood, A construction of this kind is stated to have proved itself capable of resisting pressure to which ordinary timbering and arching had succumbed, and by its durability to give favorable results with regard to economy. It appears doubtful whether any decided advantage has been proved to result from its use with regard to direct prevention of accidents. Recently suggestions have been made for the use of steel props or supports where timber is liable to perish quickly.

An undoubted step in advance has been made by the larger employment of "nogs" or "chocks" of crossed pieces of timber instead of or in addition to single props, and by the more complete and careful introduction of packing or "building" of stone in worked-out places.

The coal-cutting or kirving machines of which so many have been brought forward within the last twenty-five years, are in numerous cases ingenious and effective, but cannot yet be accepted as a practical success. Their further improvement might contribute to safety by reducing, for a given out-put of mineral, the time passed by workmen at the face of the coal, exposed to the risk of falls.

The returns from the Metalliferous Mines fully confirm the view that falls of ground, partly from above and partly from the sides, are far more productive of accidents than any other cause. In some cases, indeed, the ratio to the total number of fatalities is extraordinarily large, as for instance in Mr. Inspector Willis' district of the hæmatite mines of north-western England, where, out of a total of seventeen deaths recorded for 1883, no less than fifteen were due to falls of roof and sides.

It is the general custom in metalliferous mines that the timbering of the main ways or levels is attended to by skilled timbermen paid direct by the management, whilst the props, "stempels," or pieces requisite for the safety of the working places are placed in position by the miners themselves, as points of weakness occur. The accidents here arise mainly from delay in adopting precautionary measures, or from the attempt to keep open too large a space, from the occurrence of unexpected planes of division in the rock masses, or again from a want of skill and practical training on the part of the men. All these shortcomings are guarded against in

*From "Final Report of Her Majesty's Commissioners appointed to inquire into Accidents in Mines, etc," 1886.

†Presented September, 1881.

part by the captain's visits of inspection, in which it is usual for a manager of experience to examine the ground and give special directions with respect to the setting of the timber.

The heads of principles of safety as above given will apply to the metalliferous mines as well as to the collieries.

III.

Spontaneous Combustion.

This source of anxiety and damage, too frequently leading to fatal accidents, is fortunately limited to particular districts and to certain seams. Its occurrence is most frequently to be dreaded in the *gob* or excavated places where considerable quantities of small coal and rubbish are left behind, and in which the access of air and some amount of moisture promote decomposition of pyrites and of certain varieties of coal of a porous or finely-divided character. Moreover, it is often observable that where pillar-working is proceeding, and remaining portions of the pillars are subjected to crush and to movements causing slipping and friction, that the temperature is greatly augmented. Hence arises a very common opinion that where the coal is much comminuted and even ground to powder the temperature may be increased to the firing point.

Although the subject has been much discussed we have not found that the causes of this "breeding fire" have been more clearly elucidated since the Report of the Royal Commission on Spontaneous Combustion of Coal in Ships issued in 1876.

A paper by Messrs. Abel and Percy attached to that Report points out that "the more porous and readily oxidizable portions of coal which are known to be more or less largely disseminated through seams from different localities, undergo oxidation by absorption of atmospheric oxygen and by the exposure of large surfaces to its action, and the heat developed by that action will accumulate under favorable conditions to such an extent as soon to hasten the oxidation and consequent elevation of tempe ature, until some of the most finely-divided and readily inflammable portions actually become ignited." It appears to have been established by experience that the tendency to the development, or at any rate to the rapid extension, of combustion in coal is considerably increased by the presence of certain shales which readily yield inflammable liquids by exposure to heat.

In addition to the usual precautions of constant attention to the first effects of heating, to the system of "wax-walling," to leading out the burning material, shutting off by means of stoppings or dams, or pouring in a stream of carbonic acid gas, we may notice that the more complete packing of the gob, especially if done with argillaceous material furnishes in thin seams a valuable adjunct.

IV.

Miscellaneous Mine Accidents.

It is encouraging to observe from the valuable tables issued under the sanction of Your Majesty's Secretary of State, that the average of lives annually lost, for 1,000 persons employed under the Coal Mines Acts in Great Britain, which ratio in the years 1861 to 1870 was 3.328, has been diminished in the average of the ten years 1871 to 1880 to 2.352, and in the average of the four years 1881 to 1884 to 2.005 per thousand.

The corresponding average of lives lost in the metalliferous mines, for eleven years, 1874 to 1884 inclusive, for 1,000 persons is 1.622.

Among the different heads under which the accidents in mines are classed, it is noticeable that those termed "miscellaneous" have not decreased in number proportionately with those due to other causes, and that since 1876 the rate of improvement has not been maintained.

For the explanation of this fact, and to further the attempts at improvement which its recognition demands, we may recollect that the last three decades have seen a great change introduced in the methods of conveyance of the coal from the workings of a mine to the bottom of the shaft. We have passed from the simplicity of moving moderate quantities by manual or by horse labor to the traction of vast amounts of mineral by means of ways fitted with ropes and chains actuated by powerful engines. In some of the methods thus employed, where steam or compressed air is the motive power, the speed at which the trains are run is considerable, sometimes as much as eight or ten miles per hour. Precautionary measures against the more obvious of the classes of accident likely to occur on these engine planes are enjoined on the officials by the general rules of the Act of 1872, and by the special rules approved for the different districts.

Numerous sources of accident are, however, necessarily involved in the various arrangements for the out-put of all our large mines of coal and of stratified ironstone, and the number of accidents by tubs, *i. e.*, the ordinary wheeled underground wagons or trams, no doubt merits closer attention.

In Prussia, where among European countries the out-put of minerals and the number of workpeople employed in their extraction stand nearest to our own, a somewhat similar fact has been so remarkable as to have occasioned the issue of a Ministerial Edict addressed to the Royal Oberbergamts or mining centers, under date 25th December, 1883. This document calls attention to the circumstance, that "the increase in the number of deaths shown in the statistics of late years does not appear to be due so much to unusual and extensive accidents as to ordinary ones, affecting single persons, but occurring with lamentable frequency." Notably, the falls of rock and the accidents in haulage on inclined planes and engine roads are chiefly in fault, and it is recognized that there are certain districts, and particular mines within those districts, which show a death rate much in excess of the average. How far such regretable position may be the result of difficulties inherent in the place, and how it should be amended, are questions for anxious study in each case; but it is important to point out that these form a class of disaster which in most respects lies outside the powers of inspectors to avert, and for the mitigation of which we have to look, after the first general arrangements laid down on the best plan, to the practical experience, the coolness in danger, and the attention to discipline, of the workmen themselves.

The Prussian mines, of all kinds, employed in 1883 286,233 persons, and the ratio of deaths to 1,000 persons employed, was 2.627. But whilst the number of deaths in the lignite or brown coal mines, and in the metalliferous and other workings, is indicated by more favorable numbers, the ratio in the coal mines was as high as 3.265, calculated on 184,000 workpeople. As this is a considerable and steady increase on the proportionate total of disasters recorded in earlier years, we cannot but regard it as a remarkable contrast, and have the more satisfaction in calling attention to the improvement effected in our own country.

One class of accidents can clearly be altogether prevented. The practice prevails in South Wales of allowing boys to run with the hauliers in advance of the horses and trams for the purpose of opening and closing the air-doors. We entirely agree with Mr. Wales, Your Majesty's Inspector of Mines, in the opinion he has often expressed in his Reports, and repeated in his evidence before us, that this dangerous practice should be forbidden, and where doors are necessary the boys should remain at the doors, and the practice of allowing them to run in front of the horses and trams should be prohibited.

Several witnesses, among whom were some of the Government Inspectors and a number of the working miners from the different mining districts, called attention in their evidence to the reduction in the number of boys engaged under ground in mines, and upon fully inquiring into the matter we find that since the Mines Regulation Act has been in force, the result throughout the kingdom has been as follows:—

Ages	Persons employed underground.		Tons of Coal raised.		Persons employed per million tons raised.		Tons raised per Person employed.	
	1873.	1884.	1873.	1884.	1873.	1884.	1873.	1884.
12 to 13	11,369	3,364	128,680,131	160,759,779	87.8	20.8	11,377	47,767
13 " 16	45,931	37,032			356.9	230.3	2,801	4,341
Above 16	3.0,209	381,497			2,488.4	2,373.1	401	421

As will be seen from the record of the number of deaths from falls of roof and sides and from miscellaneous accidents under ground, the accidents from falls cause upwards of 40 per cent. of the total deaths from casualties in mines, and the miscellaneous accidents underground cause 36 per cent. of the total deaths from accidents. It is feared that a large portion are due either to carelessness or unskilfulness from the want of early training on the part of the miners, many of whom go into the mine and have charge of a working place without sufficient experience in the necessary protective work in timbering. It is found that much greater care is exercised and better discipline exists in the older established colliery districts, where the greater portion of the miners have been trained from boyhood. Such training also ensures a supply of the best practical officials for the responsible carrying on of the collieries with the least possible risk.

The importance of encouraging boys to enter the mines at the ages specified in the Mines Regulation Act, and of thoroughly training them as pitmen, practically acquainted with the best arrangements for the safest working of the mines, cannot be over-estimated; we are therefore of opinion that very careful consideration should be given to this important point in connection with the administration of the Elementary Education Act so far as it may directly affect the early practical training of boys to become miners.

V.

Fire-Damp.

The very numerous examinations which have been made, from the time of Sir Humphrey Davy to the present day, of the composition of fire-damp, that is, of the gas as it actually escapes from the strata, have been attended by such a general similarity of results, that we have not regarded it within the limits of our instructions to enter upon the question of the slight variations which may be found in the composition of pit gases. There are, however, some circumstances connected with gases

emanating from coal, and with the behavior of flames in such gases, to which we feel it necessary to call attention.

The analyses made by Mr. J. W. Thomas, Dr. E. von Meyer, and others, show that fire-damp, at all events in this country, as it comes off from blowers and from freshly cut coal, consists mainly of marsh gas; carbonic acid and nitrogen being present only in small proportions.

It is natural to infer, from the laws of the transpiration of gases through porous bodies, that if a mixture of the three gases above mentioned is enclosed in coal, the portion which escapes first will contain a larger proportion of marsh gas, while that which comes off at a later period will be comparatively rich in carbonic acid and nitrogen. The correctness of this inference is confirmed by special investigations of the authors above referred to. It is probable therefore that the gas which enters the air of a mine from blowers, possibly too small to attract attention, or from freshly cut coal faces, may, apart from its dilution with air, have a somewhat different composition from that which collects in old workings, and which makes its appearance from time to time in consequence of a diminution of atmospheric pressure, falls in a goaf, or other causes. Moreover, the relative proportions of the gases which may exist in a goaf will probably be materially affected by the occurrence of chemical changes in portions of the material in the goaf.

From the results of experiments on the behavior of gas-mixtures, when exposed to the action of an electric spark in tubes of small diameter, it has been generally accepted that atmospheres containing less than *seven* per cent. of fire-damp are not actually explosive, but our experiments with lamps in gas-mixtures have led us to the conclusion that, when little more than *four* per cent. of marsh gas is present, flame may be transmitted under circumstances which occur in a mine. It cannot be too much emphasized that results derived from laboratory experiments on a small scale with gases enclosed in narrow tubes, may be and have been entirely misleading.

If marsh gas, in a nearly pure state, enter the atmosphere of a mine, the proportion necessary to produce an explosive mixture will be so rapidly attained that the presence of the gas, as indicated by the formation of a "cap" or "aureole" on the flame of a safety lamp, may escape notice.

The gas from old workings, *i. e.*, marsh gas more diluted with carbonic acid and nitrogen, will generally enter working places already mixed with a large proportion of air, and the various stages between a mixture containing about 2.5 per cent. of marsh gas in the atmosphere, with which a cap first appears distinctly upon a flame, and an explosive mixture, will be passed through so gradually that there is much more chance of the existence of a cap being observed. This difference in the facility of showing a cap may have given rise to the prevalent idea that there exists a specially dangerous kind of gas called a *sharp* gas (known in some parts of the country as *silver* gas,) which does not give warning of its presence by causing a cap on a flame.

The gas at Garswood Hall Colliery was stated to be of this type, and a cap could only be obtained by very careful adjustment of the proportion of gas in the mixture within the narrow limits of 2.5 and something under 5 per cent. of the gas from the holder, but analysis shows that this gas was almost pure marsh gas. The gas at Llwynpia is also, as it issues from the strata, nearly pure marsh gas, but as it became largely diluted with air in passing to our gas holder, we had no difficulty in observing the changes in the cap shown upon a flame by proportions of gas from the holder ranging between 6 and 10 to 11 per cent. The gas as it issued from the strata was practically the same at these two collieries, but the slightly diluted marsh gas at Wigan showed all the characteristics usually ascribed to a sharp gas, while the greatly diluted marsh gas in our gas holder at Llwynpia exhibited the properties which are generally looked for in the examination of workings of a mine containing fire-damp.

When a mixture of air and marsh gas contains in 100 volumes of 9.38 volumes of the latter, there is just sufficient oxygen present to enable a complete combustion of the marsh gas to be effected, and a violent explosion may be produced by sufficiently raising the temperature, and so starting chemical action at any point by means of an electric spark or otherwise. Such a mixture is not, however, necessarily or even probably capable of being exploded by a flame of a safety lamp, for the following reason:

Even with the Davy lamp, which of all safety lamps allows the freest ingress to the air, the combustion of the illuminant must be rendered less active by the resistance offered to the entrance of the air and to the egress of the products of combustion. The space within the gauze must contain at all times a certain amount of inflammable vapor which has escaped combustion, and a considerable quantity of carbonic acid. This vitiation of the atmosphere immediately surrounding the flame will be much more pronounced in lamps of more complicated construction in which the intake and outlet are both small and obstructed. Now, if the most explosive mixture above referred to is passed into a lamp, it becomes considerably altered before it reaches the flame; its sensitiveness to ignition will be reduced partly from this cause partly from the chilling action of the surrounding metal, so that combustion will not be propagated rapidly through it, even if the temperature of the flame be sufficient to start the chemical action.

The supply of oxygen to the flame is certainly diminished by the entrance of gas into the lamp, and its partial combustion, which may, and probably does, take place near the flame, further helps to deprive the latter of the oxygen it requires; its temperature is consequently reduced, and it may be so much lowered that the combustion of the illuminant cannot be maintained, and the flame becomes extinguished.

In fact, this mixture of marsh gas and air, which, if tested is an eudiometer, is nearly the most explosive which can be obtained, contains too little oxygen to support the flame in a safety lamp, and at the same time to maintain around it a mixture of gases and vapors in which combustion can be readily propagated.

When the percentage of marsh gas in the air entering a lamp is gradually reduced below the value mentioned above, mixtures are attained which contain sufficient oxygen to support the flame and to leave the atmosphere immediately surrounding it in an explosive condition, and then the whole lamp may become filled with ignited gas. It is true that the atmosphere outside the lamp is not so sensitive so explosion as before; it may even be so deficient in marsh gas that an electric spark would fail to start combustion, at all events in a narrow tube; but such a mixture may become ignited under the influence of the large quantity of heat constantly evolved from the combustion maintained within the lamp, and this combustion may then be propagated through a large volume of the gas-mixture which is free from contact with bodies capable of exerting a cooling influence.

If once the ignition is propagated in a gas-mixture, it will rapidly become intensified by the increase of heat produced, and though the velocity of propagation may not be the greatest possible, the phenomena exhibited will, in the large passages of a mine, become practically those of an explosion of a formidable character.

We have found that a mixture of air and artificially prepared marsh gas, containing 5.5 per cent. by volume of the latter, cannot be ignited in an ordinary eudiometric tube by an electric spark, nor in a tube of 1.75 inches diameter by a lighted taper; but that it can be ignited, and will burn around the flame applied, in a tube only 3 inches in diameter. A mixture of air and 6 per cent. of marsh gas, contained in a tube of this diameter, propagated the combustion readily. In tubes of larger diameter, such as the box employed in our experiments with lamps, this power of an atmosphere which contains a small percentage of marsh gas, to propagate combustion, becomes more strikingly exhibited, and, in the relatively large passages of a mine, the same power would be still further developed.

In some of our experiments an ignition, with all the characteristics of an explosion, has been produced throughout the whole of our apparatus by a Davy lamp, when the current contained very little, if any, more than 4.25 per cent. of marsh gas. With about 6 per cent. of marsh gas in the air a very violent explosion was produced by a Clanny lamp.

It appears certain from our experiments that a mixture of marsh gas and air, which will produce an extremely faint cap upon the flame of a safety lamp, becomes by the addition of about 2 5 per cent. of marsh gas, converted into one which will readily produce an explosion. This important fact deserves the most careful attention of all connected with coal mines.

The researches of Professor Kreisher and Winkler upon the behavior of certain lamps in quiescent mixtures of air artificial marsh gas are in harmony with the conclusions just stated. They show in fact that the flame of a Clanny lamp is extinguished by the presence in the air of from 5 to 6 per cent. of marsh gas, while the gauze remains filled with the flame of burning gas, which in a moderate current would certainly ignite the external gas-mixture.

The condition under which the gases exist in coal and the associated strata has long been a subject of inquiry and of diversity of opinion. The gases generally escape from the freshly cut coal quietly, but under conditions as to pressure which have not yet been ascertained. Experiments, however, which are detailed below, show the pressure of the gases may accumulate to a very high point in cavities in the coal into which they discharge themselves. Moreover, the occurrence of jets or "blowers" of unusual violence, and of instantaneous outbursts which occasionally overpower all practicable ventilation, indicates that the gas is under very high pressure.

So long ago as the year 1884 eruptions of gas were observed at Pelton Colliery which were estimated at pressures of 67.5 pound to the square inch, and of 912 pounds to the square inch, or 60.8 atmospheres. At our suggestion one of our number has instituted a series of measurements of the pressures developed in cavities bored in the coal at the collieries of Elemore, Hetton, Eppleton, Bolden and Harton. The depth of the several places of observation varied from 750 feet to 1,268 feet below the surface; holes were bored horizontally, or slanting slightly upwards, of different lengths up to 47 feet. A space was left at the extreme end of the hole as a gas chamber, and the accumulated pressure was recorded every

hour by means of Bourdon's and Schaeffer and Budenburg's gauges The indicated pressures exceeded 200 pounds to the square inch in many cases, and in one (in the Bensham seam at Bolden) a pressure of 461 pounds to the square inch was attained.

The outflow of gas from these holes was not proportional to the maximum accumulation of pressure, it being in most of the experiments only moderate; a very curious result was the great difference in the maximum pressure developed, respectively, in three holes bored of different lengths parallel to and within a short distance of one another. It was also inferred that the direction of the hole with reference to the cleavage or cleat of the coal has no influence on the pressure.

With a view to gauging the gas pressure in another district, corresponding experiments were made under the direction of the Commissioners at certain collieries in South Wales, where facilities were afforded by the proprietors. At Harris' Navigation Colliery, the deepest steam coal winning in South Wales, a hole was bored 30 feet in the face of the east level, across the "slips under a depth of 2,133 feet of cover. The quantity of gas released was very small, but the maximum pressure reached 150 pounds per square inch. A second hole in the face of the west level, at a depth of 2,169 feet below the surface, was bored 26 feet 6 inches, and gave a pressure of 116 pounds, whilst the indicated volume of escaping gas was at the rate of only .287 of a cubic foot per hour.

At Merthyr Vale Colliery horizontal borings of 41 feet 2 inches and 49 feet 9 inches, at a depths of about 2,400 feet and 900 feet respectively, indicated pressures of 170 pounds and 280 pounds to the square inch, but the proximity of a neighboring working to the first hole, rendered the result inconclusive.

At the Celynen Colliery, near Newport, three holes were bored of the respective lengths of 42 feet, 47 feet 10 inches, and 20 feet 3 inches, under depths of 1,058 feet, 1,480 feet, and 1,500 feet respectively; the maximum pressures were 129 pounds, 430 pounds, and 318 pounds to the square inch.

The pressure of the gas appears from the above experiments to be extremely variable even in one and the same seam; this may be due to variations in the character and consequent permeability of the coal of the roof and floor and of the adjacent strata.

The gas issues from the pores of the coal, and from any crevices which may exist in the seam, but, owing to the smallness of the channels of communications with the face, the amount which escapes in a given time will be in general small, and the pressure of the gas in the coal probably will increase rapidly as the distance from the face, increases. The law of variation of pressure with the distance from the face, dependent doubtless on the nature of the seam, probably remains fairly constant for a considerable time in a uniform seam, subject to fixed external influences, and, if so, it follows that the rate of issue of gas from an exposed face of such a seam will be nearly constant for a time more or less long, according as the coal is more or less charged with gas.

The only external circumstances which seem capable of exerting a material influence on the escape of the gas from coal are the variations of pressure due to the superimposed strata and the effects of variation of pressure, temperature, and hygrometric state of the atmosphere upon the exposed face. The remarkable experiments described in 1876 by Mr. Hall, one of Your Majesty's Inspectors of Mines, show how greatly the escape of gas is increased by the exhaustion of the air from a surface of coal. An iron tube (4 inches diameter and 4 feet long) was tamped into a bore hole 18 inches deep, and a pressure guage was attached to it by a side tube close to the face of the coal. In the tube was an air-tight piston initially at the bottom of the bore hole. When this piston was withdrawn there would be a considerably diminished pressure on the 12 or 13 square inches of coal exposed at the end of the hole, and if gas only entered the tube at its normal rate of escape the gauge would indicate the formation of a partial vacuum as soon as the piston passed the junction of the side pipe with the main tube. In one experiment, in the Bastian seam, a slight diminution of pressure was thus produced, but almost instantly the pressure due to the gas, or to air which had been drawn into the coal and become highly charged with gas, was sufficient to balance the atmospheric pressure. When the piston was forced back into the tube the gas was driven back into the coal and escaped from points, probably small crevices, spread over an area of the face to a distance of 4 to 5 feet from the bore hole. When lighted this abnormal issue of gas burned as tongues of flame distributed over the face.

Similar experiments were tried in the Wigan 9 feet, a very fiery seam, and the Pemberton 4 feet, a seam considered to make very little gas, but in neither case did the guage show any diminished pressure in the tube, the gas atmospheric pressure followed up the piston as fast as it could be withdrawn.

The effect on the escape of gas from coal, due to a diminution of the pressure in the air of a mine, has lately been put to the test of direct experiment on a large scale in a pit belonging to the Archduke Albert, at Karwin, in Austrian Silesia. These researches are still in progress, but the preliminary report which has been issued demands attention, from the fact that the experiment referred to is of a most unusual character, and if the results obtained be correct, they would lead to important conclusions as to the escape of gas from coal under diminished pressure.

In addition to a continuous registration of the height of the barometric column in the pit and frequent chemical analyses of the air passing up the fan-drift, the effect of partially exhausting the whole pit has been tried. The downcast shaft having been closed as air-tight as possible by a wooden platform covered with clay, the fan was maintained in action at its usual speed, eighty revolutions per minute, giving a difference of level of sixty m.m. (2.36 inches) in a water gauge in the fan-drift, and the quantity of gas leaving the pit was calculated from the velocity of the current in the fan-drift and the composition of the air. In consequence apparently of a leakage from another set of workings having a distinct system of ventilation, the height of the barometer in the mine was only reduced 2-5 mm. (about 0.1 inch) below that which it would have had if the downcast shaft had been open, but the quantity of gas passing out of the mine was increased by about 83 per cent. The existence of old workings, the action of which under diminished pressure is well known, complicated the results obtained by an experiment upon an entire mine; a similar experiment was therefore tried in a district (the Karl-Flötz) not connected with any goaf, and which consisted only of an incline 190 metres (208 yards) long, with an accompanying travelling road. In this district an artificial reduction of pressure to the extent mentioned above caused an increase of 40 per cent. in the output of gas.

In other experiments the shaft from which the leakage occurred was also closed, and a diminution in the height of the barometer of 4 mm. was artificially produced, with the result that in the Karl-Flötz district the output of gas was apparently increased in the ratio of 235 to 100. Numerical determinations in this last experiment were rendered uncertain by the circumstance that, after the exhaustion had continued for seven hours, the current was found not sufficiently strong to move the anemometer, and the fan seemed to have ceased to extract air from the pit, although the difference of level in the water guage in the fan-drift remained as before, viz., 60 mm.

If the indications of the anemometer used in these experiments can be trusted, when running at a low speed, it is very difficult, with the information at present given, to reconcile the large increase of gas observed in these experiments with the fact that no equivalent increase was found when the height of the barometer fell, from natural causes, to the extent which had been artificially produced.

This possibility of an increased escape of gas from a face of coal on which the pressure is reduced is, as Mr. Hall points out, a matter of importance in considering the effect of a blown-out shot. The rush of products of explosion from such a shot must cause a lateral diminution of pressure in the air, and under certain circumstances this may affect the gas in the coal. Probably the conditions most favorable to this action are attained when a shot is fired in the end of a comparatively narrow heading and blows out along the heading; the pressure on the coal forming the sides will then almost certainly be more or less reduced, and an extra amount of gas may be thus suddenly thrown into the air. If a second shot be fired in the end of the same heading and also blown out, or emit flame, quickly after the first shot, it is highly probable that the gas just placed in its course will be ignited and produce a blast of a formidable character.

The fire-damp having exuded from the strata makes its way into the workings, and will hang or lodge in old workings, goaves, cavities, and recesses which are insufficiently ventilated, or beyond the reach of ventilation. The means of guarding against or dealing with such gas accumulations vary much with local conditions in individual collieries. In certain plans of working it has been found an excellent precaution to carry a return airway along the rise side of the workings. In others a special gas-drain is cut to meet a liability to the accumulation of large volumes of gas hidden from observation in places from which it may be suddenly liberated. With some seams, the removal of the coal may be followed immediately by the descent of a certain thickness of roof, leading to the impression that the roof is falling in the ordinary way. If above this fallen stratum a layer of tougher and yielding material exists, with smooth parting between it and an overlying strong rock, the latter may stand unbroken over a large area while the former may gradually sag, thus leaving an open space, which if even only a few inches in depth may form a receptacle for a dangerous accumulation of gas. This gas, when a fall of the hard roof occurs, will be forced down and an explosive atmosphere may thus be formed in the workings. There is some reason for thinking that some of the unexplained disasters, like the terribly fatal explosion at Abercarne in 1878, may have been due to this cause. Where conditions of this nature are likely to exist either the introduction of a rise drain, or a very close packing of the gob, coupled with the use of really safe lamps, becomes essential to security.

It is scarcely possible to draw a distinct line of demarcation between the escapes of gas to which the name of "blower" has been applied, and the more unusual, rapid, and

violent eruptions to which very serious attention has been called both in Great Britain and in Belgium within the last few years.

There is no doubt about the frequency and the capriciousness of the occurrence of blowers wherever seems of coal have a "fiery" character. They vary in magnitude, from the minute escapes called "pipers" which hiss and bubble on the face of freshly bared coal, to the large volumes of gas which issue in powerful currents.

Accumulations of gas in a state of very high compression, and to which the name of "bags of foulness" has been given, have occasionally escaped suddenly and with great violence, the emission of gas lasting only for a brief time. They have been described by some of the leading engineers of the first half of the present century, together with the means employed by the officials for combating them in a slack and feeble ventilating current either without a protected lamp or with only the first and simplest form of safety lamp. Men were not unfrequently asphyxiated and their lamps extinguished by the almost undiluted gas; yet the low speed of the ventilating current then generaly met with and the time consequently required to produce an explosive mixture with air, have sometimes favored escape from very critical surroundings.

(TO BE CONTINUED.)

Municipal Engineering; Paper No. 3.*

WASHINGTON, D. C.

(*Continued from Page* 197.)

Sewerage.

The sewerage of the city of Washington is on the combined plan, and all sewers are constructed of such size as to provide for a rainfall of 2 inches per hour, on the assumption that it all reaches the sewer within the hour, together with the regular house-drainage. The two combined, give about 5 cubic feet per second for each 100,000 square feet of area. This gives a larger sewer than is usually considered necessary, but experience has shown that for well paved, closely built portions of this city it is none too large. To test this question a self-recording gauge was constructed and placed in a sewer having a diameter of 8 feet, which drains an area of about 200 acres, mostly paved with asphalt and thickly built up. By comparing the hourly record of this gauge with that of the signal service, which is near by, it is found that during storms the two correspond very closely, the water rising in the sewer very soon after the beginning of a rain, and falling to its normal height very soon after the rain ceases. Large sewers proportional as above, the discharge being computed by Kutter's well-known formula† have more fall, showing the necessity for this large allowance, or a modification of the formula. The following table shows the length, in miles, of sewers of all different sizes in use in the city:

Plate 20 shows the standard sections of sewers in use at the present time. By refering to the following table it will be seen that quite a large proportion of those in use are circular brick sewers. These were mostly put in a good while ago, the present practice being to make everything above a 24-inch pipe egg-shaped until a size of about 10.0 feet × 15.0 feet is reached. No pipe smaller than 8 inches diameter is now laid.

As shown in the accompanying drawings the pipe sewers, varying in size from 8 inches to 24 inches in diameter, are laid in concrete, having a thickness of 6 inches underneath and at the sides. The joints are protected by a band laid in hydraulic cement. T branches are put in for house connections when the sewers are laid out and a record kept, giving the distance from the nearest manhole, hence connections are 6 inches in diameter. In egg-shape brick sewers varying in size from 2 feet × 3 feet up to and including 4 feet × 6 feet the invert consists of half a terra-cotta pipe set in Portland cement. For all sizes larger than these the invert is built of trap or granite paving blocks set in Portland cement. In brick sewers terra-cotta junction blocks for hand connections are put in just above the springing line. All angles are turned with curves of a radius usually not less that 50 feet.

All sewer pipe, of branches, junction blocks, and stone blocks for inverts and furnished by the city.

Manholes are built at an average distance of 150 feet apart. For small sewers less than 5 feet in height they are built directly over the sewer, but for all larger sizes they are tangent to one of the sides, so as to give access to the sewer without a ladder. Formerly the manhole covers were ventilated as shown, (Plate 21) but there was so much complaint where they were

LENGTH OF SEWERS OF VARIOUS SIZES, WASHINGTON, D. C.

Diam.		Miles.	Diameter.		Miles.	Size.	Miles.
Ft.	In.		Ft.	Ins.			
1	6	1.530	8	6	0.450	12 feet span	0.430
2	0	4.430	9	0	0.790	24 " "	0.090
2	2	0.120	9	6	0.410	30 " "	1.310
2	6	2.630	9	9	0.460	15×17.5 oval	0.380
3	0	9.986	10	0	1.380	D shape	0.588
3	6	2.810	13	0	0.130	Total brick	57.860
3	8	0.280	20	0	1.640		
3	9	0.140	22	0	0.420	Pipe Sewers.	
4	0	5.190				Feet In.	Miles.
4	6	1.940	Egg shape.			4	0.070
4	10	0.054	2.5 × 3.5		0.030	6	0.660
5	0	1.480	2.5 × 3.75		0.720	8	2.160
5	3	0.050	2.75 × 4.12½		1.000	10	0.170
5	5	0.020	3.00 × 4.5		0.620	1 0	89.370
5	6	0.980	3.25 × 4.87		0.910	1 3	34.630
5	6¼	0.095	3.50 × 5.25		0.480	1 6	22.560
5	8	0.068	3.75 × 5.62		0.970	1 8	1.110
6	0	3.380	4.00 × 6.00		0.600	1 9	0.710
6	2	0.080	4.25 × 6.37		0.190	2 0	3.450
6	3	0.230	4.50 × 6.75		0.360	Total pipe	154.890
6	6	0.630	5.25 × 7.87		0.080		
7	0	0.280	5.50 × 8.25		0.890		
7	6	0.350	5.50 × 8.87		0.280		
7	9	0.040	6.50 × 9.75		0.670		
8	0	1.120	7.00 × 10.50		0.260		
8	3	0.130	Irregular		shapes		

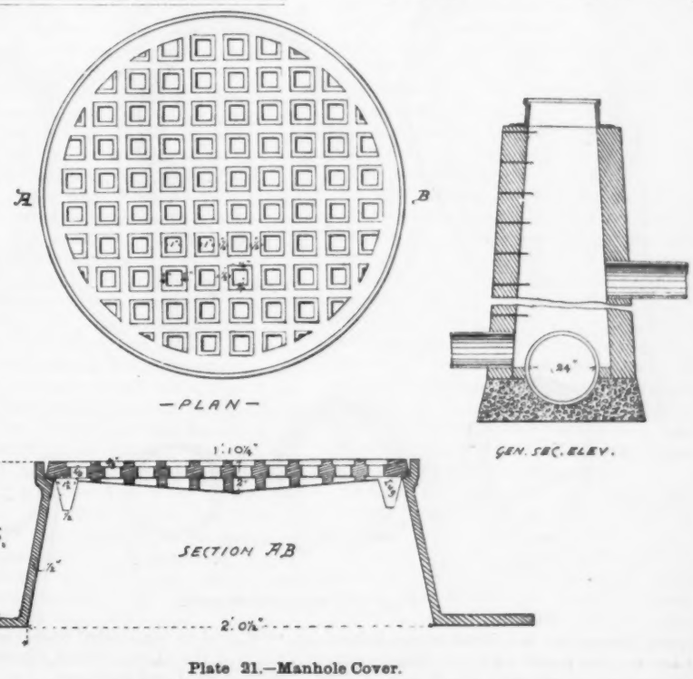

Plate 21.—Manhole Cover.

TABLE 2. SHOWING SIZE, RELATIVE CAPACITY AND MATERIAL REQUIRED FOR VARIOUS SIZES OF SEWERS, WASHINGTON, D. C.

Size.	Area. Sq. feet.	Hydraulic radius.	Relative capacity.	Concrete. Cub. feet.	Brick Masonry. Cub. feet.	Pipe. Size in inches.	Pipe. Lin. feet.	Trap in sq. feet.
12"	0.73	0.25	1.00	1.69		12	1.0	
15"	1.23	0.31	1.84	2.33		15	1.0	
18"	1.77	0.375	3.05	2.40		18	1.0	
21"	*2.40	0.438	4.65	3.20		21	1.0	
24"	3.14	0.500	6.68	3.35		24	1.0	
2.0' × 3.0'	4.64	0.567	10.81	3.88	4.680	12	0.5	
2.25' × 3.37'	5.92	0.649	15.17	4.225	5.128	15	0.5	
2.50' × 3.75'	7.23	0.700	19.40	4.165	5.521	15	0.5	
2.75' × 4.12'	8.71	0.787	25.51	4.643	6.099	15	0.5	
3.0' × 4.50'	10.41	0.857	32.46	5.360	6.620	15	0.5	
3.25' × 4.87'	12.13	0.937	40.15	5.393	7.134	18	0.5	
3.50' × 5.25'	14.10	1.010	49.26	5.622	7.683	18	0.5	
3.75' × 5.62'	16.19	1.099	59.30	6.270	8.213	18	0.5	
4.0' × 6.0'	18.54	1.150	70.69	6.347	8 624	21	0.5	
4.5' × 6 75'	23.26	1.300	95.75	6.010	8.660			4.550
5.0' × 7.50'	28.71	1.450	126.44	7.330	8.650			5.310
5.25' × 7.87'	31.67	1.521	144.84	7.800	9.860			5.310
5.50' × 8.25'	34.74	1.590	163.13	8.138	10.135			5.938
6.0' × 9.0'	41.61	1.738	205.89	12 830	15.000			6.080
*6.5' × 9.75'	48 53	1.882	254.60	15.612	16.832			6.768
†6.5' × 9.75'	48.53	1.882	264.60	26.250	7.270			6.768
7.0' × 10.50'	56.27	2.027	309.25	14.730	17.160			7.770
*10.0 circ.	78.54	2.500	493.03	17.376	27.598			10.470
†20.0 "	314.16	5.000	3016.73	130.421	28.512			15.908

* Brick arch. † Concrete arch.

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$$\dagger\ V = \frac{41.66 + \frac{.002807}{S} + \frac{1.8133}{n}}{\left(41.66 + \frac{.002807}{S}\right)\frac{n}{\sqrt{R}} + 1}\sqrt{RS}$$

in which

V = velocity in feet per second.
R = hydraulic radius.
S = Slope = sine of angle of inclination.
n = constant of roughness, adopted value = 0.013.

in the sidewalks and near houses that now they are only used on sewers that are in the carriage-way; and many of those put in sidewalks and parking have been closed up with cement.

The drop for dry weather flow, shown in Plate 20 is put in where it is deemed inadvisable to pollute the stream with sewage where the outlet is, except in a very dilute form. The ordinary flow runs over the stone

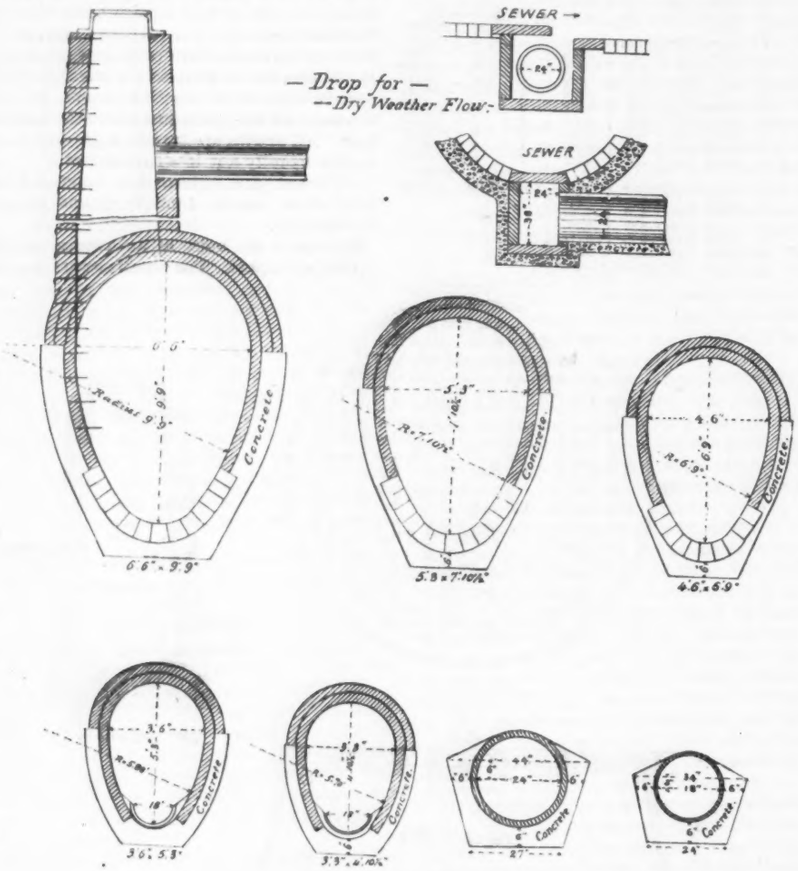

Plate 20.—Standard Sewers.

sill into the square box, from which it is carried by a pipe sewer to the drained outlet; while during a storm when the flow is greater, it will leap over the sill and pass on to the main sewer.

In many of the larger sewers concrete has been used for the arch, using only a lining of one thickness of brick. Thus far these have given good satisfaction and the cost is considerably less than for brickwork.

The perforated manhole covers mentioned above are the only means of ventilation.

Table No. 2* gives the size, area, hydraulic radius, relative capacity for most of the different sizes of sewers now considered standard in this city, together with the quantities of material required per running foot of sewer.

TO BE CONTINUED.

An explosion of 1,000 pounds of giant powder occurred at Baychester, N. Y., on September 30, on the property of the Dittmar Powder Manufacturing Co. Four men who were at work in the building were killed, being literally blown to pieces, and the shock was felt at West Farms, where a roof and many windows were smashed, and at Morrisania, eight miles distant. No explanation of the cause has been given.

*Taken from the Annual Report of Capt. F.V.Greene, Assistant of the Engineer Commissioners for the year 1884.

Convention of the National Brick Manufacturers' Association, held at Cincinnati, Ohio, September 22 and 23, 1886.

Reported for ENGINEERING NEWS.

CINCINNATI, O., Sept. 24, 1886.

Pursuant to a call signed by many of the leading brick manufacturers throughout the country, the first convention of brickmakers ever held in the United States met in the club room of the Grand Hotel, Cincinnati, on September 22nd and 23rd inst.

It is a matter of some surprise that this, one of the oldest of industries, should be the youngest in perfecting a national organization, and the event might have been delayed for even a longer period had the clay-working interests not assumed such a degree of overshadowing importance, as at the present time.

Our country is still in its formative period. We are a nation of builders, and the question as to what shall constitute our present and future building material, is an extremely significant one. Time seems to prove that for durability, solidity and appearance, brick is to be the material that will be most extensively utilized for structural purposes. Within the past decade it has made rapid strides, and a high degree of excellence has been allowed in its manufacture. The skill of the inventor has been taxed to meet the demand for mechanical improvements used in its fashioning. There are many different methods, various qualities of clay and diversity of ideas and opinions; for this reason annual conventions for all industries become a necessity, for, in comparing notes, there results more of a unity of interests and less clashing of ideas. It is an old saying, "that two heads are better than one," and the present and future welfare of any industry is promoted by occasional meetings of those concerned.

PROCEEDINGS.

The convention convened at 10 o'clock Wednesday morning, September 22nd, in the club room of the Grand Hotel. The meeting was called to order by Capt. J. M. Blair, of Cincinnati, who made a short address of welcome to the delegates, of which there was a goodly number from all sections of the country. J. J. Billingsley, of Indianapolis, was elected temporary chairman; T. A. Randall, of the same city, temporary secretary. The following Committee on Permanent Organization was named by the chairman:—D. V. Purington, Chicago; J. J. Billingsley, Indianapolis; R. B. Morrison, Oakdale, Ga.; J. C. Adams, Indianapolis, and R. W. Blair, New Richmond, Ohio. While the committee were out several short addresses were made as to annual meetings, etc.

The committee reported the following constitution, which was unanimously adopted:

Article 1. This Association shall be known as the National Brick Manufacturers' Association.

Article 2. The object of this Association shall be to promote the interests of those engaged in the manufacture and use of brick, by the discussion of various important questions and the interchange of experience in improved methods of clay work.

Article 3. Any person directly interested in the objects of this association may become a member by signing this constitution and paying the sum of two dollars annually.

Article 4. The meetings of this association shall be held annually, at such time and place as shall have been agreed upon by ballot at the previous annual meeting.

Article 5. The officers of this Association shall consist of a President, Vice-President, Recording Secretary, Corresponding Secretary and Treasurer, who shall be elected by ballot at each regular annual meeting.

Article 6. The officers of this Association shall constitute an Executive Committee.

Article 7. This constitution may be altered or amended by a two-thirds vote of the members present at any annual meeting.

Mr. Randall, secretary, stated that the object of the Association was to promote the interest of those engaged in the manufacture of brick, and that any person in sympathy with the object could become a member by signing the constitution and paying a fee of $2.00 annually, at which invitation most of those present paid the annual dues, signed the constitution, and became members. A permanent organization was then effected, with the following named officers:

President, W. A. Eudaly, Cincinnati, Ohio.

Vice President, J. A. Blaffner, New Orleans, La.

Recording Secretary, Wm. D. Gates, Terra-Cotta, Ill.

Corresponding Secretary, T. A. Randall editor of the *Clay Worker*, Indianapolis, Ind.

Treasurer. Adam J. Weckler, Chicago, Ill.

All of these gentlemen made short and appropriate addresses, upon the conclusion of which the convention were ready for work, and the programme for the meetings were read and adopted. A recess was then taken until 2 o'clock P. M.

Afternoon Session, Sept, 22.

Meeting called to order at 2 o,clock. Mr. Anthony Ittner of St. Louis made the motion that without delay the programme be begun.

The first paper was entitled "Our Association," read by Mr. D. V. PURINGTON, of Chicago; who started out by saying that he would try and set an example for brevity, which promise was fulfilled in his very interesting paper. He spoke of the manufacture of brick, its gradual evolution from primitive times, and the great importance its manufacture was assuming at the present time.

A short discussion followed Mr. Purington's article.

The next subject was "Economy in Mining

Clay," by R. W. Blair of New Richmond, Ohio. Mr. Blair explained the difficulty of mining clay at an early period, and the gradual improvements that have been made in the methods and machinery used in extracting the clay from its bed. He illustrated the present process of mining; and thought that many improvements could yet be made. He suggested that machines be made strong enough for the toughest clay. Mr. Blair mentioned the Marion Machine for that purpose.

Mr. Purington thought that Mr. Blair's paper was too much of an advertisement for machines.

Mr. Ittner of St. Louis, hoped that the Convention would not be made a side show for patent machines, which resulted in something of a tilt between Messrs. Ittner and Blair.

The next subject chosen was; "Tempering Clay," by S. A. Charles of Lexington, Ky. Mr. Charles explained his method of preparing clay for use, and gave his ideas as to the proper way in which it ought to be tempered.

The paper brought up quite a discussion which was followed by an article on "Brick Making in the South," by R. B. Morrison, of Oakdale, Georgia. Mr. Morrison stated that most of the brickmakers in the South are using mechanical appliances, that the clay used is strong and plastic and burns a bright red color; the supply of same being inexhaustible. He explained the different qualities of clay, in different parts of the State of Georgia; also in Tennessee, Florida, Kentucky and North Carolina. He stated that Florida was noted for a scarcity of clay, Ohio river clay makes a No. 1 brick, that Macon, Ga., makes 1,000,000 brick annually, Albany, Ga., 6,000,000, Memphis, Tenn. 27,000, Lexington, Ky., 6,000,000, Louisville, Ky., 60.000,000, New Orleans, 40,000,000, Richmond, Va., 25.000,000, Goldsboro, N. C., 4,000,000, considerable being made by hand as well as by machinery.

A vote of thanks was accorded Messrs. Morrison and Charles for their excellent papers.

A discussion on the merits of machinery for elevating clay followed. Messrs. Hall of Toledo, Ohio, Martin of Lancaster, Pa., and Purington of Chicago made remarks on the subject. Mr. L. P. Holt, of Montgomery, Alabama, spoke on the subject of drying brick.

A paper on "Dry Pressed Brick," by F. P. Meyenberg of Chicago, was read by the Secretary, on account of the author's inability to be present. The writer thinks that the "semi-dry process" is the foregoer of an entirely new process of brick manufacturing, and that more attention should be given to the material to be worked; the semi-dry process is much less of a failure than the knowledge of it.

A discussion from Mr. Adams of Indianapolis, and others followed.

Mr. George E. Noyes, of Georgetown, D. C., made some remarks on the machinery used in the manufacture of semi-dry pressed brick. Mr. Noyes is the inventor of the "Automatic Dry Press Brick Machine," that makes from 500 to 800 brick per hour. He has one of his machines at the Cincinnati Exposition.

The question was asked as to the cost of mining clay.

Mr. Anthony Ittner, of St. Louis, replied that it cost him about 70 cents per M.

Mr. Purington, of Chicago, said that at first the cost was 45 per M. and at the present time 17 cents.

Mr. Adams, of Indianapolis said it cost him 50 cents per M.

Mr. Purington, of Chicago desiring to know whether there were any clays that would not vitrify in drying, was replied to by J. R. Kemp, of Youngstown, Ohio, who gave a short address on vitrification. He thinks St. Louis clay superior to all others.

Mr. Chambers, of Philadelphia, also made some remarks on the subject.

Dr. Brown, of Indianapolis, gave a short address on dry pressed brick, upon the conclusion of which the meeting adjourned until 9 o'clock A. M. Sept. 23.

Morning Session, Sept. 23.

The morning session of the second day of the convention opened with a much larger attendance than on the previous day. It was 9.30 o'clock before the meeting came to order. The Secretary read an invitation from the President of the Cincinnati Board of Trade inviting the members of the Convention to visit the Chamber of Commerce, which was accepted; the members attended in a body at noon and were addressed by Gen. Hickenlooper, the President.

The first paper read was by Mr. R. B. Wilson, of Cincinnati, on the "Artificial Drying of Brick." Mr. Wilson stated that brickmaking consisted of three processes: molding, drying and burning; he gave an explanation of the different methods employed in drying, and considered the tunnel system superior to any in use. Mr. Wilson's paper was somewhat theoretical in its drift.

Mr. J. D. Caldwell, of Menomonee, discussed the paper and thinks that artificial heat is desirable in many cases.

Mr. D. V. Purington, of Chicago, gave his ideas on the same subject.

"The Past History and Future Prospects of Brick Making," was next read by Dr. Ryland T. Brown, of Indianapolis, Ind. Dr. Brown began his discourse by giving a history of the making of brick, from its infancy. He spoke of some of the noted buildings of antiquity that were constructed of brick, among them being the Tower of Babel and many of the splendid buildings in ancient Babylon and Nineveh. India and China never used brick extensively. At no stage of its history has brickmaking been more prosperous than at present, many new features in its manufacture being constantly introduced, among them the use of gas in drying. He thought the building materials of the future would be brick; and terra cotta will supply the place of ornament. The poor man will build of brick because it is the cheapest, and the rich man will use it because it is the best material.

Dr. Brown's paper was one of the most interesting and valuable contributions to the convention. The author is a chemist, geologist and agriculturist, and from this fact the paper gave evidence of much knowledge of the subject as well as thorough research.

Dr. Brown was accorded a unanimous vote of thanks for his learned article, and was made an honorary member of the association.

Dr. Brown's paper was followed by some remarks on the drying of brick.

Messrs. Purington, of Chicago, and Blaffner of New Orleans gave their experience in the matter of drying.

Mr. Jones, of Columbus, Ohio made a short address on the utilization of heat in kilns, which was exceedingly interesting. Other discussions followed. The next paper on the programme was "Heat Furnaces," by W. A. Eudaly, of Cincinnati, Ohio, the President of the Association. The writer stated that the object of his address was to show how the greatest amount of heat was to be obtained from any fuel. The different gases were described, various kinds of coal were analysed and air and heat explained. The position of the different gases was shown and the amount of air admitted in furnaces was considered to be a very important point in hardening the clay. The address evinced much scientific investigation.

Mr. Eudaly was accorded a unanimous vote of thanks for his able contribution.

Mr. Eudaly's paper gave rise to much controversy the writer giving an explanation on all points, not clearly understood.

Adjourned until 2 o'clock P. M.

Afternoon Session, Sept., 23.

Meeting called to order by the President.

Mr. Penfield of Willoughby, Ohio, made some remarks on the drying of brick, followed by Mr. L. P. Dodge, of Montgomery, Alabama, who gave the details of an experiment in that direction, which he considered could be relied upon as a successful one.

"Brick in Paving Streets," was the subject of an article by J. J. W. Billingsley, of Indianapolis, Ind. The writer explained the advantages of brick over other pavements, stating that they may be burned to sufficient hardness to supplant stone. All the principal streets of Charleston, S. C., were paved with hard burned brick, as were also some streets in Bloomington, Decatur, Galesburg and Springfield, Ill. Mr. Billingsley thought that brick pavements would gradually come into use, but that the larger cities would not use them until their durability had been tested by the smaller places.

A vote of thanks was given Mr. Billingsley.

"Preparations of Clay, and Manufacture of Brick by the Dry Clay Process," by Anthony Ittner, of St. Louis, Mo., was the next paper read. Mr. Ittner is a strong advocate of the dry clay process, and considered that it was yet in its infancy. He gave a history of the machine used; stated that buildings were erected of dry brick in Cincinnati in 1833, thought buildings constructed of them would last one thousand years or more. The clay must be well pulverized, and the brick thoroughly burned. Dry brick will ultimately take the place of all others.

A lively discussion followed Mr. Ittner's interesting paper, and a vote of thanks was carried.

A paper on "The Brick Interest of Haverstraw," N. Y., by T. A. Brockway, of Haverstraw, was read by the Secretary, Mr. Brockway being unable to be present. The writer gave a historical sketch of Haverstraw, and stated that the clay bank first began to be worked there seventy-six years ago, in the year 1810, by a firm of brickmakers from Philadelphia. James Wood was the founder of the brick industry there in 1815, and a sketch of brick making there at different periods was given. At present there are fifty brickyards in Haverstraw, making 40,000 bricks each per day, using 10,000 tons of coal during the brick making season.

Mr. Brockway's paper gave rise to numerous remarks on the antiquated processes of manufacture in Haverstraw.

Mr. Purington suggested that a committee be appointed to do missionary work on the banks of the Hudson.

Mr. R. B. Morrison, of Oakdale, Ga., had something to say on the burning of brick, followed by Mr. Ittner of St. Louis, and Mr. Parmale of Columbus, Ohio.

The motion was made by Mr. Purington of Chicago, that each member of the convention bring a sample brick of his own manufacture to the next meeting. Carried.

The question was asked as to the process of enameling brick.

Mr. Purington of Chicago, referred the interrogator to a good encyclopædia for information on that point.

The paper on "Soft Brick as a Building

(Continued on page 221.)

ENGINEERING NEWS

AND

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TRIBUNE BUILDING, - NEW YORK CITY.

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Subscribers who wish to have complete files of this year's numbers of ENGINEERING NEWS *must make application at once for missing numbers or to replace mutilated copies. We will give one month's subscription for each copy of Nos. 13 and 14 of this year, uninjured, mailed to us during October. In wrapping cover the whole length of the paper, otherwise they arrive with torn leaves and we will not accept them.*

A full page portrait of Major General John Newton, U. S. A., Commissioner of Public Works, New York City, accompanies this number of ENGINEERING NEWS, *which is not complete without such inset.*

THIS is verily an era of tunnel and canal building on a hitherto unprecedented scale. The latest submarine tunnel is one proposed by M. Alexander Rothe to commence at or near Copenhagen and thence passing under the *Drodgen* to the island of Saltholmen, and under the *Flintrenden* water to the town of Malo on the Swedish coast. The actual length of the tunnel is estimated at six and one-half miles and the engineer proposes to enclose it in a tube of cast-iron; he figures the cost at $6,250,000 and the time of completion at three years.

The promoters promise much in the way of increase in commerce; but the Scandanavian government is wary and asks for further particulars and guarantees before granting the 99-year concession and 40-year monopoly demanded for the enterprise. Swedish imports, as a rule, come from a long distance, and it is questionable whether the tunnel will pay.

ENGLISH railway and financial journals are somewhat exasperated over the action of Mr. Winston, the late United States Minister to Persia. This gentleman is charged with having obtained a 99-year concession from the State for a railway from the Caspian sea to Teheran, and then offering his rights to the Russian government for a cash consideration.

As the concession grants mile-wide strips of land through some of the most fertile regions of Persia, and a southern extension is proposed from Teheran to the Persian Gulf, our English contemporaries think the Russians will be inclined to look upon the affair favorably both from a commercial and a political standpoint. The American promoter of this Persian railway is apparantly looking out for his personal interests only, as he proposes to build the road with Russian engineers, labor and material of all kinds.

SEVERAL years ago the graduates of the Rensselaer Polytechnic Institute, at one of their annual meetings, passed resolutions requesting the Board of Trustees to fill vacancies in the board by the election of graduates of the Institute.

A correspondent of *The Engineering and Mining Journal* now calls attention to the fact that the Board of Trustees are doing nothing of the kind. At the last election, of several weeks ago, four graduates were nominated for the four vacancies and but one was elected; the electing board at present standing six graduates to eight non-graduates. The full board now contains seventeen non-graduates to eight graduates, providing that the members lately elected accept, and the latter seem to have little chance of increasing their numbers.

The Barber Pavement on Chambers Street.

In June last the Mayor approved an act of the Board of Aldermen allowing the Commissioner of Public Works to contract with the Barber Asphalt Company to lay their pavement on Chambers street from Broadway to Center street, and the Commissioner has just, as authorized, awarded the contract.

The surveyors' estimate is for 2.334 square yards of Trinidad and 300 yards of granite block pavement, at $4 and $3 a yard respectively. The granite blocks are to be laid on each side of each of the street railroad rails, lately laid through that street, toothing into the other pavement in alternate blocks, 8 and 12 inches long.

The specifications for the pavement prescribe a foundation of American cement one part, sand two parts and three parts of stone broken with a hammer, on which are to be laid two thicknesses of Barber pavement, which follows the usual specifications.

While we, with every other citizen who cares for either the health, ease of circulation, or appearance of the city, rejoice at an effort to lay monolithic pavements, we can but regret that a street containing a railroad track has been selected. Our streets have so long recalled the following lines of Coleridge:—

> "In Köln, that town of monks and bones,
> And pavements fanged with murderous stones,
> And rags, and hags, and hideous wenches,—
> I counted two and seventy stenches,
> All well defined and several stinks!"—

that the bordering inhabitants do not seem to know that a pavement can be laid impervious to the filthy water of the streets, noiseless under passing traffic, that can be kept *clean*, instead of presenting numerous receptacles for liquid filth, one on which both the load and life of a horse would be nearly doubled, and that by its imperviousness and cleanliness would reduce the death rate of the city by at least one per thousand.

The apathy resulting from gross ignorance can only be dispelled by example and experience, and unfortunately a street with a horse railroad, as is shown by the difference in the use of the pavements in front of the New York Hospital and that in front of the Florence Flat does not attract travel however smooth it may be. Some street without a railroad, extending from river to river, should be paved with this or some other equally good pavement, and the concentration of travel on it would soon show its advantages to horse owners and users, while its freedom from noise and stenches would commend it to owners and renters of property.

The Life-Time of Pumping Machinery.

In last week's issue we published a paper by Mr. Alfred R. Wolff on "The Selection of Steam Pumping Machinery," which incidentally suggests a point, which appears to us worthy of discussion. This is: What is the proper annual allowance to be made for deterioration of, and repairs to steam pumping machinery? In other words, what is the life-time of such machinery, and what the expense of repairs necessary to secure said life-time?

Statistics of actual results alone can serve as a satisfactory reply. Authentic records would certainly be interesting and useful, and we should be glad to find space for them in our columns. Average results relating to a given class of machinery would, of course, be preferable to exceptional results, but the latter are, however, most apt to come to the front.

Again from one aspect—that of recent progress in design and construction—it would not appear unlikely that the pumping engines constructed to-day, and which, necessarily, have not yet secured a time record, will prove more durable and less expensive in repairs than those of the past; though from another aspect, there is plausible reason to question this, since the competition of later years has induced an economy in design, and placed a demand for work and consequently a strain on a given sized plant far in excess of what was the case years ago.

Certainly, in the matter of durability, the old pumping engines have a splendid record; and for that matter their fuel economy is not to be despised, when we remember (See Sir William Thomson's Mathematical and Physical Papers") that the "engine of Fowey Consols Mine was reported in 1845 to have given 125,089,000 foot-pounds or effect, for the consumption of one bushel of 94 pounds of coal," and that "the best duty on record, as performed by an engine at work (not for merely experimental purposes) is that of Taylor's engine at the United Mines, which in 1840, worked regularly for several months, at the rate of 98,000,000 foot pounds for each bushel of coals burned."

The actual economy of these engines should, however, not be measured, by their fuel record, for their small pumping capacity for a given size and cost of plant, made their work rather expensive, when annual interest on first cost is taken into account, as it should be. But their durability was doubtless increased by their slow working and the comparatively small strain placed on the several parts.

We believe this question of life-time and expense of repairs of pumping machinery to be well worthy of discussion as a practical, vital problem, especially in its relation to the economy of the duty obtained in modern pumping

machinery. We feel certain that practical data bearing on this topic will be cordially welcomed by the profession.

The Proper Dimensions of Chimneys.

The engineer, who has occasion to inspect steam power and heating plants, finds as a common source of lack of economy of the plant, that the chimney proportions are inadequate. Since the draft is an increasing function of the flue area and height of chimney, and also of the temperature of the escaping gases (products of combustion), it follows that if the height and area of a given chimney flue are insufficient, the only way to obtain the requisite natural draft, if it can be secured at all without change of proportions of the chimney, is by an increase of the temperature of the products of combustion. The result is that the gases frequently leave the too small chimney at an abnormally high temperature and represent an enormous amount of waste of fuel.

Table Showing Sizes of Chimneys for Steam Boilers.

Diameter of round Chimney, in inches	HEIGHT OF CHIMNEY.										Side of square Chimney, in inches
	50 ft.	60 ft.	70 ft.	80 ft.	90 ft.	100 ft.	110 ft.	125 ft.	150 ft.	175 ft.	200 ft.	
18	23	25	27	.....	.....	.....	.....	.....	.....	.....	.....	16
21	35	38	41	.....	.....	.....	.....	.....	.....	.....	.....	19
24	49	54	58	62	.....	.....	.....	.....	.....	.....	.....	22
27	65	72	78	83	.....	.....	.....	.....	.....	.....	.....	24
30	84	92	100	107	113	.....	.....	.....	.....	.....	.....	27
33	.....	115	125	133	141	.....	.....	.....	.....	.....	.....	30
36	.....	141	152	163	173	182	.....	.....	.....	.....	.....	32
39	.....	.....	183	196	208	219	.....	.....	.....	.....	.....	35
42	.....	.....	216	231	245	258	271	.....	.....	.....	.....	38
48	.....	.....	.....	311	330	348	365	389	.....	.....	.....	43
54	.....	.....	.....	.....	.....	449	472	503	551	.....	.....	48
60	.....	.....	.....	.....	.....	565	593	632	692	748	.....	54
66	.....	.....	.....	.....	.....	694	728	776	849	918	981	59
72	.....	.....	.....	.....	.....	835	876	934	1023	1105	1181	64
78	.....	.....	.....	.....	.....	.....	1038	1107	1212	1310	1400	70
84	.....	.....	.....	.....	.....	.....	1214	1294	1418	1531	1637	75
90	.....	.....	.....	.....	.....	.....	.....	1496	1639	1770	1893	80
96	.....	.....	.....	.....	.....	.....	.....	.....	1876	2027	2167	86

The gases when they leave the boiler and enter the chimney should not exceed the temperature of the steam and water in the boiler more than 50 degrees Fahr., or with the steam pressures now in current use, should certainly not have a temperature in excess of 400 degrees Fahr. Any material excess above this amount, and frequently this excess is measured by hundreds of degrees, represents waste of fuel, which can be readily—and, comparatively speaking, cheaply—prevented by increasing the height or flue area (or both) of the chimney. On the other hand, too large a chimney, though not necessarily a source of fuel extravagance, represents waste of money in the outlay.

It becomes important, therefore, to know exactly the proper dimensions of chimney for a given horse power of boiler plant,—dimensions which will secure the requisite draft, with the least money outlay, and with a temperature of the escaping gases not more than about 50 Fahr. degrees in excess of the temperature of the steam and water in the boilers.

The accompanying table, for which we are indebted to the last Transaction of the American Society of Mechanical Engineers, Vol. VI, is presented by Mr. William Kent, M. E., as in the main fulfilling the conditions outlined by us. The figures given are based on correct theoretical analysis and embody the results of approved practice. We note that they agree substantially with those which other American engineers, whose specialty is steam engineering, have found adequate and economical practice, and differ but slightly from the figures representing the best English practice, cited by the Messrs. Bancroft in their recent work on "Tall Chimney Construction."

The horse power of boiler referred to is the generally adopted standard, viz., the hourly evaporation of thirty pounds of water into dry steam from feed water at 100 degrees Fahr., and under a pressure of seventy pounds per square inch above the atmosphere.

The table will, it is believed, be found useful in new designs. We should also advise our readers to compare the dimensions of their chimneys with those given in the table, as this may prove the initiatory step to changes which will materially increase the economy of their steam plants.

Work at Flood Rock.

Lt. Col. McFarland has notified the Pilot Commissioners that there is now an 18-foot channel below mean low-water, made by the removal of the Negro Heads and Hen and Chicken rocks at Flood Rock. About 30,000 tons of rock have been dredged up and removed since the explosion of last year. The channel is now 12 feet deep for a distance of 150 feet beyond the 18-foot channel which is itself from 350 to 400 feet wide.

This new channel will admit vessels drawing 21 feet of water and from 1,800 to 2,100 tons displacement to the port of New York from the Sound. Vessels drawing 16 feet can pass through at any time. Congress has appropriated $112,000 for dredging work during the coming year, and this, it is estimated, will remove another 30,000 or 40,000 tons of rock. At this rate it will take seven or eight years to complete, and Lt. Col. McFarland thinks that the annual appropriation should be raised to $500,000.

Progress at Panama.

The *Bulletin du Canal Interoceanique* for September 15, gives a total cube of excavation for the month of August last, of 901,000 cubic metres; of this quantity Gatun furnished 254,000, and LaBoca, 135,000 cubic metres, these being the largest quantities for any one station. The promised monthly average of "one million cubic metres" for the present year is being closely touched.

The Tenement Houses of New York.

But few of the citizens of the United States realize how closely mortals can be packed under one roof, and they must come to New York to see how and to what an extent it can be done.

In this city there are 28,500 tenement houses, including all buildings that are occupied by several families, and ranging in character from the Navarro and Dakota flats, costing millions, to the rookeries of Mott and Baxter streets.

The Nineteenth Ward, of this city, contains the greatest number of tenement houses; the tally being 3,101 homes occupied by 25,850 families, or an average of nine families to one house. This ward has an area of 1,480 acres and a population of 158,191, or about 106 to the acre. This latter is a low average as compared with some of the smaller wards; in the Tenth Ward, with 110 acres, there are 47,554 inhabitants, or 432 to the acre. This is the most densely populated section of the city.

The Tenth Ward is the great Jewish section, and it contains 1,077 tenements occupied by 10,740 families. The Thirteenth Ward, adjoining the Tenth on the east, contains 107 acres, with 37,797 people, or 353 per acre; and its 874 tenements contain 5,661 families.

While the above estimates of families per unit of area are interesting, and seem startling enough to the countryman or the dweller in small towns, they are really valueless as expressing the actual densities of population. In fact, a large part of the area specified is covered by extensive buildings devoted to manufacturing and commercial purposes, and in many cases fully one-half of the area should be deducted in an estimate of this character; and as a result, the total population must be crowded onto the other half. Figured in this manner, the Sixth Ward, with 86 acres and 20,196 inhabitants, would have an actual density of about 468 persons per acre.

In the Eleventh Ward, some buildings contain as many as twenty families; and a lot, 25 by 100 feet, will furnish "homes" for at least thirty families. It is even stated that there is one building in New York which covers about one-quarter of an acre and furnishes beds for from 1,200 to 1,500 people.

Why Is This?

In our last issue, we published a table from the paper of Mr. Edward Bates Dorsey, read at the last Annual Convention of the American Society of Civil Engineers, at Denver, entitled "English and American Railroads Compared."

The figures contained in this table caused so much surprise among railroad men, that we publish below a more complete table of comparison from the same paper, viz:

TABLE No. 46.

London and North Western Railway, of England, Compared with the Pennsylvania Railroad Division of the Pennsylvania Railroad, of the United States:

1884.	London and North Western.	Pennsylvania Railroad Division.
Total length of line operated	1 811	1 471
Aggregate daily trains over entire line	68	45
Average annual train mileage per mile of line operated	21 086	14 135
Average load of freight trains, tons	78	205
Average passenger trains, passengers	38	42
Average of all trains, tons and passengers	58	160
Average Cost of Transporting One Ton, or One Passenger One Mile.	**Cents.**	**Cents.**
Maintenance of way	.209	.103
Repairs and renewals of locomotives	.082	.044
Total cost of motive power	.271	.148
Total operating expenses	1.130	.530

From the preceding table it appears that the actual cost of transporting one ton, or one passenger, one mile on the London and North Western is about double what it is on the Pennsylvania, in maintenance of way, repairs and renewals of locomotives, motive power and total operating expenses. To this last item, for the London and North Western, there should be allowed a large credit, as owing to the average length of haul for freight being shorter on that road than on the Pennsylvania, the terminal charges are proportionately greater.

We hope our English contemporaries will publish this table in full, so that engineers can see it and explain why this great difference should exist in the cost of the different

items of operating expenses of two first-class roads.

We again repeat, that in our opinion, it is owing principally to the superiority of the American rolling stock—especially the locomotive—this is proved beyond question by the cost of "Repairs and Renewals of Locomotives," *the English cost being double that of the American.*

Sea Water for Watering Roads and Flushing Sewers.

G. R. Andrews, C. E., the surveyor to the Bournemouth (England) Commissioners, reports as follows on the use of sea water, in watering roads and flushing sewers, as obtained in the answers to queries directed to numerous other cities and towns:

The town surveyor of Portsmouth says that he has introduced the use of sea water on the streets, and that the effect lasts longer and consequently requires less water; he thinks the salt water slightly disintegrates granite paving, but it tends to bind gravel roads and thus improve them. The effect of watering with sea water is no doubt to cause a greater dampness on the road surface than that obtained with fresh water; and, in addition, a sort of skin or film is formed on the road, tending to keep down the dust and preserve the surface. In regard to the effect of brine on organic matter, he said that less of a nuisance was created than when fresh water was used. The scheme was economical, as the sea water cost for pumping only three-pence per thousand gallons as against six-pence paid the Water Company, and two loads of sea water went as far as three loads of fresh. The objection made that the use of salt water in shopping streets is likely to damage delicate goods by reason of the damp air, is not sustained by proof.

In Harwich, salt water has been used for sewer flushing since 1879 with very satisfactory result. The town surveyor of this place says further that in his experience, salt water keep the dust down at least twice as long as fresh water, and the cost of obtaining and distributing the sea water is from 25 to 27 per cent. less than the cost of fresh water at one shilling per thousand gallons.

The Grimsey surveyor says that the salt water on drying leaves a thin coating of salt on the road surface which prevents the rising of dust and keep the road moist.

Other towns all responded in a generally similar manner and testified to a great saving in cost by the application of sea water to sewer flushing.

Such is Fame!

A little story told us by an engineer suggests the above remark; and it is too apt an illustration of the fickle public's appreciation of the engineer's duties and responsibilities to be allowed to be let slip. If in print before, we will only pass it on.

The story goes that a stranger in our city was attracted by the magnitude and commanding importance of the Brooklyn Bridge; he gazed at it for awhile and then turning remarked to a citizen standing near:—"That is a magnificent bridge. Who was the engineer?" The answer promptly came:—"Can't say, stranger, who built it; but Brodie was the name of the man *who jumped off.*"

Oregon Short Line.

We understand the Idaho Mining and Irrigation Company intends to resume in the early spring, vigorous work upon their dams and canals, with the intention of completing all within eighteen months. These works, when completed, will irrigate 600,000 acres of very fertile farming land,—south and west of Boise City, Idaho, besides supplying with water for hydraulic mining the extensive gold placers on the Snake and Boise rivers.

It is estimated that every acre of irrigated farming land will produce directly and indirectly over one ton of freight per acre annually. As the Oregon Short Line runs for sixty miles through this tract, it will soon receive from these irrigated farms alone 600,000 tons of freight yearly, most of which will be to and from the Missouri river, giving a haul of thirteen hundred miles. In 1885 this road handled a total of 341,000 tons of freight, with an average haul of 254 miles—this tract alone will soon give it in addition nearly double the number of tons, with more than double the length of haul. The additional passenger traffic will also be very large.

These who are best posted predict that within a short time after these irrigation works are completed, the Union Pacific Railway will be in the receipt of an income from this tract alone, much greater than that now received from all the traffic of the Oregon Short Line.

It seems that the very sanguine prediction, made by the United States Government Director of the Union Pacific, to President Arthur in this official report of 1884, of the great increase of business to be expected to the railroad in the future, from irrigating the adjacent desert lands, will soon be realized.

Cleaning Tracing Linen.

Two further contributions are received, suggesting methods for handling greasy tracing linen. Mr. J. S. Nye says he has found "an old silk handkerchief" convenient and effective; and Mr. M. D. Makepeace testifies to the merits of "powdered chalk" rubbed over the surface of the linen, or a few drops of *aqua ammonia* in the ink to improve the flow.

Reducing the Co-efficient of Friction.

MINNESOTA AND NORTHWESTERN R. R.,
ST. CHARLES, KANE CO., ILLS. Sept. 23, 1886.
ENGINEERING NEWS PUBLISHING CO.

Dear Sirs:

I received the letter which you returned to me requesting me to send my old address. I cannot understand why you want my old address when I want you to send my paper to St. Charles, Ills. I know where I want my paper sent. This is the second time you have done this. If you cannot send the paper where I want it don't send it at all.

The old address where you have been sending it, is Tobasco, Ohio, Clermont Co., don't send it there any more. I am Yours truly. ——

[We publish the above letter as a hint to the more migratory portion of our subscription list. The writer evidently thinks that his personality is so commanding that we carry him in our memory always as well as on our list, and as long as we know where he is it is of no account to us where he *was* recently. It is just there that he is mistaken; we follow up the wanderings of anywhere from 25 to 100 different engineers and contractors *each week* according to the season of the year and the activity of business; we can very easily send their papers to their new address, but we cannot so easily look up their last address as, for mailing purposes, names are recorded by States and also in special lists for more rapid mail delivery, and not alphabetically: hence the importance of giving last address in ordering a change. So we *will not* send to a new address, until we are given the last address. As a practical example of how easy a matter it is, and how small a strain upon the temper it involves, we publish the following received in the same mail, with that of our St. Charles correspondent:

CHICAGO, KANSAS AND NEBRASKA RAILWAY CO.
ENGINEERING DEPARTMENT,
NORTH TOPEKA, Sept. 20, 1886.

ENGINEERING NEWS PUBLISHING CO,
Gentlemen:

My former address was Brayton House, Newport, R. I. Please change to North Topeka, Kansas. Yours, etc.
F. L. WHEATON.

That is as simple as "rolling off a log."

The Repaving of Fifth Avenue, New York.

The second report of Col. Geo. T. Balch to the Commissioner of Accounts of New York City, on the repaving of Fifth Avenue, has appeared. It is very voluminous and detailed in its exposure of the methods employed, both by the contractors and by the late officials of the Department of Public Works in charge, and from it we make such extracts as are of general interest to engineers.

The official report is dated Aug. 4, 1886, and the work done on Fifth Avenue, to July 24, was reported as follows:—Paving-blocks and bridge-stones laid and jointed, 4,147 lin. feet; concrete foundation laid, 5,574 lin. feet; bridge-stones laid, 8,600 lin. feet. At contract prices the above work represents upward of $100,000 earned, provided that the specifications had been complied with in all respects.

The report then goes on to describe the manner in which the work was done, and first defines the materials to be used as follows: The value of the sand and gravel entering into this work will be nearly $40,000, and is hence an important item. The contract specifies the use of "clean, hard, dry gravel, artificially dried * * this gravel shall be free from sand and shall be such as can be passed through a sieve of three-fourths of an inch mesh and retained by a quarter of an inch mesh." The report in defining "sand," quotes from Van Cotta's Treatise on Lithology, and adopts the "grain of mustard seed," there referred to, as a standard of maximum size. When tested it was found that all these seeds would pass through a No. 8 mesh. Based on this line of reasoning Col. Balch gives the following as proper definitions of the materials to be used in connection with street paving:—

"*Sand.*—An accumulation or aggregation of loose or incoherent grains of silicious, calcareous, or argillaceous material derived from rocks or other mineral matter, in which the grains are not larger than a mustard seed; or referred to a fixed scale, such as will pass through both a No. 4 and a No. 8 mesh.

But as "clean, sharp sand" is demanded by the specifications, the contract sand to be used here is further defined as "an aggregation of silicious grains, crystalline in structure and angular in shape, unmixed with either earthy or organic matter, and of a size which will pass through a No. 8 mesh."

"*Gravel.*—As an aggregation of water-worn fragments of silicious, calcareous, or argillaceous material derived from rocks or other mineral matter, of a size from that of a small pea to that of a hen's egg; or referred to a fixed scale, too large to pass through a No. 8 mesh."

"*Shingle.*—As loose, imperfectly rounded water-worn stones, or pebbles of any material derived from rocks, or other mineral matter, of a size from above that of a hen's egg to that of an average 'cobble' or 'paving' stone."

The reasons given for the use of clean, sharp sand, and not gravel, for the bedding of paving blocks, are that this base should be of a medium, the dry particles of which would, as the blocks are rammed, quickly adjust themselves to every irregularity of their in-

ferior surfaces. And when the blocks finally settle in place, the sand should furnish a solid, incompressible medium to transfer pressure to the concrete foundation beneath. On the other hand, the coarser this intervening material and the damper it is, the more difficult will it be for the blocks to adjust themselves, and the fewer will be the points of support between the latter and the concrete, and the greater is the pressure of contact, and liability to unequal settlement.

The sand should be "perfectly free from moisture," because it is an absolute necessity in this class of pavement, that there be not only no moisture under the paving-blocks when laid, but that these blocks be jointed in a manner that shall make them absolutely water-tight. Should water penetrate below the blocks the effect of frost would be to upheave the pavement, or crack the concrete.

The above being the general conditions for some of the pavement materials as called for by the specifications under which the contractor was working, the report then goes on to show how these specifications are being fulfilled in the Fifth Avenue job:—

"No attempt has been made to screen the sand used," and the engineer for the Commissioner found it much mixed with "small stones" and he "found men digging out large stones from the gravel spread on the concrete;" the "gravel" used was much nearer the definition given for *shingle*; and on analysis, the "sand" used gave "2.45 per cent. of earthy and organic matter, 32.35 per cent. of gravel, and 65.20 per cent. of sand." The sand itself was very good, but out of every 100 loads of this so-called sand, thirty-five loads were of a character not represented in the specifications for this part of the work. The report also states that this sand was frequently wet by the rainfall, in violation of the specified "freeness from moisture." But just how the contractor was going to prevent this infraction of contract in wet weather is not stated; though the specifications do refer to the use of "artificial heat if necessary." The engineer found large areas (8,490 square feet) of the uncemented pavement exposed to soakage from storms, and saw the men laying paving-blocks while "the water would form in little pools in the sand."

The report then goes deeply into the theory of the laying of paving-blocks, and shows that while it may be practically impossible to have blocks all of the same size, it is possible to attain the same general end, of securing a perfect pavement, by assorting the blocks delivered, and using together only those that approximate closely in size. As the pavement was laid no such attempt at assorting was made, and blocks of all sizes, from 3 × 6 × 8-inches to 5½ × 8¾ × 14-inches, were used indiscriminately as they came. The result of this latter method is shown by the ultimate unevenness of surface resulting from unequal settlement into the character of "sand" substratum used throughout this work, and very generally found in all New York street paving.

The position of wedge-shaped blocks as laid in the pavements is also treated upon. The practice of the workmen was to "invariably lay these blocks with the widest side up." While blocks of this form are not recognized in the specifications, the practice followed is wrong; the purpose seems to be to give a close surface joint, but the effect is to interfere with and practically prevent the proper application of the paving gravel and cement, and to permit the block to be forced down by the pressure of traffic. If such blocks are used at all, the wide base should be at the bottom.

The report very properly next takes up the subject of "inspection," and suggests that there exists "an evident misapprehension" as to the meaning of the word *to inspect* and the nature of a *bona fide inspection*. The specifications define very clearly the size of blocks which shall be passed; they shall be in fact "dimension stone" in one sense of the word. The report then shows that all these conditions of inspection were either totally disregarded or most perfunctorily performed; blocks were continually being delivered without any inspection and laid at once as they ran; many imperfect blocks have thus been used to the profit of the contractor. On a revised estimate of the number of blocks on the avenue that would be rejected under rigid inspection, the report puts this quantity at 30 per cent. of the whole number delivered. The Commissioner's inspection also showed that many of the blocks used were unequal in hardness and consequently differed in their ability to resist abrasion.

The specifications for ramming the blocks and cementing the joints were also disregarded. The "white gravel" used for jointing contained over 45 per cent. of sand, and this sand is detrimental by sifting down below the larger gravel, and effectually preventing the hot cement from properly permeating that portion of the joint. The contractor is charged with rather using the rammer so as to secure a general evenness and uniformity of surface, than to *bring each block to an "unyielding bearing."* The result of the surfaceing process is to produce an unsightly uneven roadway when the pressure of traffic is brought upon it.

The specifications for cementing the joints state that the paving cement must be poured into the joints, when heated to a temperature of 300° F., until the joints are full, and then dry hot gravel is to be poured along the joints and consolidated by tamping with a light rammer. Prior to June 9, the gravel was simply broadcast from a shovel over the joints, few of the pebbles adhering to these joints, and no rammers were used at all. Since that date a 7-pound rammer has been brought upon the work but used without any useful purpose.

The cement pitch, upon which the waterproof qualities and the permanence of the pavement depends, is actually applied in such manner that the Commissioner's Engineer gives a cement band 1½ inch deep as a fair average of the whole. The reason given is the temptation to substitute the cheaper gravel for the pitch, and the estimate is made that the contractor "saved" about $12,168.00 by so doing.

In regard to the material used in the concrete, the method of laying this concrete and in shaping the roadway transversely, the report goes into fuller detail than space will here permit to repeat. The following summary of the various items where it is estimated that the contractor saves outlay by disregarding specifications, will give the general reader an idea of the charges made:

In not being obliged to excavate 16 inches below legal grade, by reason of the crown of the roadway having been raised 3 inches above the legal grade	$5,000.00
Not being obliged to roll or ram 26,110 feet of road-bed	5,000.00
Saving in cement to June 24 in not observing formula for making concrete	1,614.00
By imperfect inspection of cement	2,441.00
By 15,800 cubic yards of "sand"	7,900.00
In laying concrete from failure to properly ram the foundation and to lay concrete full thickness to June 26	14,128.00
The difference in cost between a quality of jointing gravel in conformity with the contract and that in daily use	2,000.00
Saving in quantity of paving pitch by using a poor quality of jointing gravel	12,136.00
Saving due to imperfect blocks laid in the pavement	23,940.00
Aggregate amount	$74,189.00

Col. Balch then concludes that "these omissions and defects in construction indicate that up to this time the special object and purpose of the statute 'to secure the best description of pavement, of the best material and workmanship, to be laid in the most substantial manner and with the best foundation' has as yet not been complied with either in the spirit or the letter."

He further says that it does not require the trained eye of an engineer to detect the violations of the contract and places the responsibility for all this wrong doing, first, with the *Engineer*; second, with the *Contractor*, and lastly with the Commissioner of Public Works.

The duties of the engineer are carefully defined, but in this case all such duties were grossly neglected and he permitted the contract to be daily and constantly violated without protest. In answer to the query why he does not resign, Col. Balch shows by a table that Surveyor J. McI. Smith, who was in charge of this work, and is a brother of the late Deputy Commissioner of Public Works, was the "engineer" for 94.03 per cent. of all the street work being done between February 19 and July, 1886, of an aggregate estimated cost of $2,148,268. The ratio of the fees of surveyors to the aggregate cost of the works is represented by 3.26 per cent. of this cost as deduced from all contracts let in the Street Improvement Bureau from 1882 to 1885. Applying this rule, Surveyor Smith's fees would amount to $70,033.54. As this young man is not a recognized civil engineer, and proved this statement by his own testimony before the Commissioner of Accounts, and he has been acting as a City Surveyor for six or seven years only, this is quite a snug professional income to be gathered in by about eighteen months of evidently very easy work. Col. Balch expresses the situation clearly when he says that "the manner in which, and the extent to which this officer has neglected his duty, is only exceeded by his incapacity as an engineer."

As to the responsibility of the contractor, the views of Mr. Allan Campbell, Commissioner of Public Works, from 1875 to 1880 are quoted. Mr. Campbell expressed himself as follows:—"There seems to be a misapprehension as to the obligation and duty of contractors in carrying on works which they have undertaken. Provision is made for the employment of inspectors, whose duty it is to be upon any work to which they may be assigned, and they are required to be vigilant in the discharge of their duty; but this by no means relieves the contractor of his obligation to supervise his own work and to fulfill to the letter the terms of his contract. If an inspector is absent or negligent, or should even consent to the allowance of inferior work, this affords no excuse to the contractor, and he can be compelled to repair and rebuild, at his own cost, any work thus imperfectly done. The specifications are explicit, and the contractor can read in them his plain duty."

The plea that the Department of Public Works has of late years failed to thus rigidly enforce contracts, and that it is unfair to the present contractor to make him a victim of a new policy, is not a valid one. This contractor voluntarily assumed certain contracteobligations, and if he did so with a secret conviction that the terms would not be enforced, he must abide by the consequences of any unexpectedly rigid inspection of his work. He took the risk of being detected, and the lesson, while severe in his especial case, is deserved, and in effect will be salutary.

The report finds the Commissioner of Public Works personally responsible for the proper execution of the work and for the acts of his subordinates. In this case, after his attention had been called to the facts in the case, the Commissioner failed to fully investigate and

showed an evident desire to shield the offenders.

The various "exhibits" appended to the report of Col. Balch furnish some rather rich reading; among others is the voluntary certificate of a clergyman of this city who has constituted himself an expert in street paving and writes to the late Commissioner Squire, a letter deprecating the adverse criticism on this job and testifying to the general good qualities of the material and workmanship. It is to be hoped that this reverend gentleman is better informed in the doctrines he preaches than he is in the ways of city paving contractors; the intention was doubtless good, but this intention will only furnish one more bit of paving material for that unmentionable far-off country to which this good man probably frequently refers in his sermons.

PERSONAL

J. H. PEARSON has been appointed Chief Engineer of the Evansville & Chicago R. R.

SEABURY S. GOULD, President of the Gould's Manufacturing Co., Seneca Falls, N. Y., died at Watch Hill, R. I., on September 4th, at the age of 75.

JOHN W. HILL, Mechanical Engineer, 21 Glenn Building, Cincinnati, having resigned the office of Consulting Engineer to the Cincinnati Water Department, and resumed his professional practice, respectfully solicits correspondence with former clients and others who may require services in his line.

MACE MOULTON, Assistant Chief Engineer of the Kentucky & Indiana Bridge at Louisville, Ky., has accepted the position of Engineer of Bridges of the Colorado Midland R. R. His headquarters will be at Colorado Springs, Col., and he commences the duties on Oct. 1st.

ALFRED NOBLE, M. Am. Soc. C. E., recently connected with the extension of the Northern Pacific Railroad, has been appointed resident engineer on the construction of the new Harlem River Bridge—to fill the vacancy caused by the resignation of William F Shunk.

R. E. PEARY, Civil Engineer, U. S. Navy, who is spending eight months leave in Arctic explorations, has a letter in the New York *Herald*, of September 20th, dated at Godhaven, Greenland, June 14th, which point he had reached on board the steam sealer *Eagle* rom Sidney Harbor, after a voyage of fourteen days. He expects to date his next letter from edge of the "inland sea."

BENJAMIN F. SPARR, of 53 St. John's place, Brooklyn, a young architect, sues Edward F. Linton, a builder and real estate owner, for $1,372.45 damages for breach of contract. Sparr alleges that he was engaged by the defendant at a salary of $1,500 a year for six months. If the business increased, which it did, he was to have $2,500 a year and one-half of all the money earned outside of Mr. Linton's own work. Suddenly, without warning, Sparr was dismissed, the only reason assigned for the action being that he was much too dignified for the position. He now sues for the balance of salary under the agreement.

M. JUIBERT, a mechanical engineer, of Paris, recently made an invention which is said to increase materially the speed of railway travel. The journals discussed the matter at length and predicted for M. JUIBERT a great future. However, the other day, as the inventor sat in his workshop, a stranger suddenly rushed towards him and began belaboring him with a cane, exclaiming excitedly: "This will teach you not to make such murderous inventions that will enable my mother-in-law to reach my house in six hours instead of in twelve." M. JUIBERT caused the arrest of his assailant, who is said to be a well-known merchant by the name of Bolivet.

JOHN D. TAYLOR, late Treasurer of the Pennsylvania R. R. Co., died in Philadelphia on Sept. 25, in the 61st year of his age. Mr. Taylor was a native of Philadelphia and was at one time connected with the firm of Taylor, Gillespie & Co.; in 1873 he was made Treasurer of the East Broad Top R. R. & Coal Co., and a year later he was appointed Assistant Treasurer of the Pennsylvania R. R. In April 1878 he succeeded Bayard Butler as Treasurer of the latter company, Mr. Butler having resigned on account of ill health. Mr. Taylor was until lately a man of robust health, but for a year past had been showing evidences of failure; he attended the funeral of the Assistant Treasurer of Pennsylvania R. R. Co., Mr. William H. Frailey, about two weeks ago.

"THE ease with which a clever wag can sometimes fool those who deem themselves very keen, was exemplified this afternoon," says the Washington correspondent of the Baltimore *Sun*. "Last year Assistant-Secretary of State Adee attempted to take a photograph of several buildings. His colors ran, and the result was that his proofs presented a group of buildings falling in every direction. The walls of some were bulged out and others falling in. He had some blue prints made of the remarkable production, and recently one of them was passed around the departments. The print was passed off as taken from an instantaneous photograph of the earthquake at Charleston. It was stated that the first shock awakened the photographer, and he got his traps together, rushed into the street, and got an excellent negative of the second shock. All of the officials and clerks believed the story. Some of them went into a scientific dissertation over the blue print. They all endeavored to explain why the buildings on one side bulged out and on the other appeared to be falling inward. At last one of the clerks, laughing at his befooled companions, called their attention to the fact that the earthquake occurred at night."

First Annual Report of the Forest Commission of the State of New York.

The Legislature of the State of New York, on May 15, 1885, passed an Act creating a forest commission, to be made up of three commissioners acting without compensation, except reasonable expenses, but empowered to employ forest wardens, inspectors and clerks. By the terms of the Act, this commission is to have the care, custody, control and superintendence of the forest preserves of the State of New York; with regard to forests and tree planting, forest fires, trespass, etc. The commission is further to prepare and circulate plain and concise advice for the care of woodlands on private estates, the starting of new plantations on denuded lands, etc.

The present commission, consisting of Messrs. Townsend Cox, Sherman W. Knevals and Theo. B. Basselin, have now submitted their first annual report.

The eleven counties of the Adirondack region include the forest preserve of this State, and they cover an area circular in general outline and about 100 miles in diameter. With but little exception this is an unbroken wilderness, wild and mountainous. The Adirondack region proper contains over 4,000,000 acres, of which the State has acquired title to over 800,000 acres. In the Catskill region, on the water-shed of the Hudson and Delaware rivers, the State owns over 50,000 acres.

Much of the land now belonging to the State has passed to it by reason of tax-sales, after the original owners had removed all of the soft timber and some of the hard timber, and regarding it as practically valueless, had permitted its sale for accumulated taxes. As these lands are now protected from spoliation and damage, the young soft timber will grow up in years and the forest assume its primitive condition. Many good country roads traverse these regions, kept in repair by private contribution, and railroads skirt the entire tract of the Adirondack, but seldom penetrate the wilderness to any extent, and none cross it.

The causes tending to decrease the area of forest lands within the counties of the forest preserve are, fires, windfalls, lumbering, tanning, wood-pulp manufacture, charcoal burning, railroad building and farming.

The fires start from a great number of causes, generally from carelessness, sometimes with malicious intent. In 1880, the total area burned over in the State of New York was 149,491 acres, and the value of the property destroyed was estimated at $1,210,785.

According to statistics gathered by the commission in the preserve, the annual output of lumber in these counties is 213,000,000 feet B. M. Estimating that the average tree yields two and one-half standard logs of 13 feet long by 19 inches top diameter, the one tree would yield 500 feet B. M.; or, to produce the above amount of lumber, 427,000 trees must be cut down each year.

The wood-pulp interests involve a clearing process and utterly denude the land and deprive the soil of the proper moisture for further tree-growth. Some mills in this part of the State consume 5,000,000 feet annually each.

The Railroad Commissioners of New York, give a mileage of 908 miles of railroad as touching the counties included in the forest preserve. The danger from these lines is mainly from forest fires; but their construction and maintenance also annually consume large amounts of timber; every two cross-ties mean, practically, the destruction of a vigorous, healthy young tree, and this in itself is no light drain on the timber lands.

The report then enters into a description of the various other agencies at work in the destruction of timber, and then gives a brief sketch of the methods adopted for timber preservation in European countries.

The commission, in accordance with the requirements of the Act creating it, have prepared and here publish a series of rules and regulations concerning the lighting of fires, the use of fire-arms and the peeling or girdling of trees in the forest preserves.

An interesting portion of the report is devoted to the effect of forest removal on water supply. In the Adirondack region the covering soil is peculiar; on the mountain sides there is no sub-soil, but in its place are rocky ledges with gravel of various degrees of coarseness. In the valleys there is sand and gravel accumulated from the denuded hills. The surface soil, from a few inches to 3 or 4 feet in thickness, is made up of the gradual accumulation of vegetable growth or decay. This soil has no adhesive consistency, nor much weight, but is loosely held together and affords free access of air and resisting changes of temperature. With the forests removed, it soon washes away, and when fires occur the vegetable structure of the soil is also consumed, and the remaining scanty soil soon disappears under mountain storms.

As viewed by the Commissioners, forests promote rainfall, prevent cyclones, temper the force and severity of winds; they purify the air and impregnate it with sanatory properties; they prevent sudden changes of temperature and enhance the profits of agriculture by favorable climatic influence.

The most important of these effects is their capacity for the retention and gradual discharge of rainfall. By reason of their structural peculiarities these forests are great, natural reservoirs; and retain and distribute with even flow the waters falling upon them. This main storage is in the forest soil, which as stated before is very porous; and the leaves shading it from the sun delay evaporation. The water thus stored gradually filters into or through the subsoil and eventually finds its way to the rills and springs that again unite to form larger lakes or streams.

The removal of these forests, by denuding the rocks of its loose soil would produce the rapid removal of the rainfall by destructive floods and the loss of this fluid at the season when it is most required by loss of its storage features.

As a note of warning the Commission refers to the reports of the New York Superintendent of Public Works, who annually points out the decrease in the volume of the rivers which furnish the water, and calls for additional dams and reservoirs.

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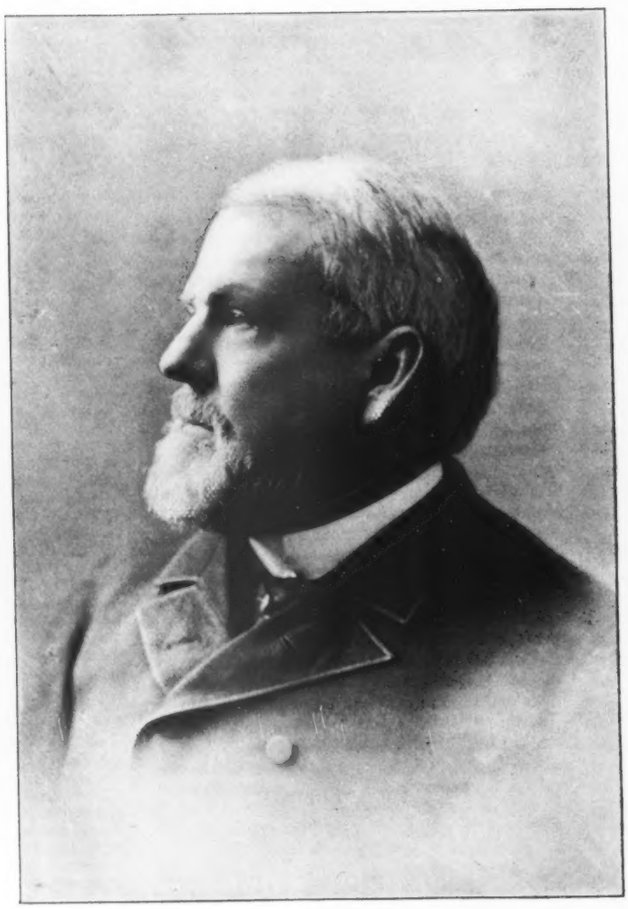


MAJ.-GEN. JOHN NEWTON, U. S. A.
(From Photograph by Falk.)

In conclusion the Commission approves of a regularly appointed holiday, to be called *Arbor Day*, after the plan already successfully adopted in various Western states. This day is to be devoted to tree-planting, tree culture and education in forestry. But as the climatic conditions in this State are so diversified as practically to forbid any one day for all sections, the commission suggests that the actual tree planting be done in each section as the local conditions are most favorable, and that later in the season the Arbor Day exercises be held in such manner and by such observances as to divest the proceeding of the simple prosy details of an agricultural process.

Another suggestion, and one that has a poetical as well as a practical side, is to adopt Decoration Day as the date of the Arbor Day, and to dedicate trees to the names and memories of the soldier dead of the rural districts, whose bodies lie often in unmarked graves on distant battle-fields. The memory of this private soldier is as dear to his kindred as that of the man honored in storied marble; and the tree, fostered by loving care and bearing a tablet properly inscribed, would for generations be a noble monument and probably outlast the crumbling stone of the village churchyard.

A valuable appendix to the report is a voluminous "Bibliography of Forestry," including the full titles, dates and location by library, of all accessible works which treat of this subject now recognized as an advanced science.

Major General John Newton, U. S. A.

(With Portrait.)

Maj. Gen. John Newton, late Chief of Engineers, U. S. A., and recently appointed Commissioner of Public Works of the City of New York, was born in Virginia in 1823. He entered the Military Academy at West Point in 1838, and graduated in 1842 s cond in a class of fifty-six cadets. Lieut. Newton was retained at the Academy as Professor of Engineering until 1846, when he was appointed Assistant Engineer in charge of construction at Fort Warren in Boston Harbor. Oct. 16, 1852, he was promoted to First Lieutenant, and in 1856 to Captain of Engineers.

At the outbreak of the Civil War Captain Newton was made a Major of Engineers and put in charge of the erecti n of the works which were being hastily thrown up for the defence of the City of Washington, D. C. On the completion of his duties there, he was commissioned as a Brigadier-General of Volunteers, and commanded a brigade in the Peninsular campaign under General McClellan and took part in the battles of Gaines Mill and Glendale.

From this time forward until the close of the war General Newton was in continuous service; he was twice brevetted for gallantry in the field, first as Lieutenant Colonel U. S. A. for work done at Antietam, and then as Colonel for the gallant manner in which he handled his division at Gettysburg, being in the latter battle placed in command of the First Army Corps after the death of General Reynolds in the first day's battle. After several months service with this Corps, General Newton was ordered to the southwest as commander of the Second Division of the Fourth Corps in Sherman's invasion of Georgia, and thus participated in the famous March to the Sea. From Oct., 1864, to June, 1885, he commanded the district of Key West and Tortugas; and at the close of the war he held the rank of Lieutenant-Colonel of Engineers, U. S. A. and Brevet Major-General of Volunteers. In 1879 he became full Colonel, and on the death of General Humphreys in 1884, he was made Brigadier General and Chief of Engineers.

General Newton's services as an engineer officer have been varied, but his name will always be chiefly connected with the removal of the obstructions to navigation about New York and especially at Hallett's Point and Flood Rock in the famous Hell Gate region. In 1867, General Newton first examined these obstructions and reported a plan for their removal, and thus securing a channel not less than 25 feet deep at low water. Briefly stated, work was commenced on Hallett's Point in 1869; and on Sept. 24, 1876, a charge of 47,781 pounds of dynamite was fired which completed the displacing of over 50,000 cubic yards of rock, and thus removed, in a comparatively short time after, the chief and most dangerous obstacle to the navigation of Hell Gate. The work on the equally important Flood Rock was also designed by General Newton, and carried out on a principle similar to that used by him at Hallett's Point, *i. e.*, by first excavating by a series of intersecting tunnels as much of the interior mass of the rock as was possible, and then blowing up the roof and the supporting pillars of rock. Flood Rock, or that portion operated upon, had an area of nine acres, being about 1,200 feet by 625 feet in its largest dimensions. This rocky mass was traversed by over 21,000 lineal feet of tunnel, and these were finally stored with about 280,000 pounds of dynamite and rack-a rock. This unprecedented volume of high explosives was fired on Oct., 10th, of last year, and the work of removing the shattered débris is now actively going forward.

Being so long identified with the promotion of the commercial interests of New York City, General Newton is undoubtedly better known in this region than any other officer of the Engineer Corps; and the public hailed with unanimous approval the wisdom of the choice of Mayor Grace, when he announced the name of this gentleman as the one selected to fill the much abused position of Commissioner of Public Works of New York City. The duties of this office are most important as being so intimately connected with the expenditure of vast sums for the general improvement of the city, and the extension of its water supply; and General Newton is eminently fitted by his ability as an engineer, experience as an executive officer, and undoubted probity of character, to fill the office in a manner creditable to his own reputation, and profitable to the citizens of New York.

Penetration of Light in Water.

According to *Engineering* further experiments have been made by MM. Fol and Sarasin to determine the depth to which light penetrates the water of lakes and seas. Their method of observing consisted in placing gelatino-bromide photographic plates at different depths under the water, the plates being lowered by a sounding lead, and protected from the action of the sea-water by a varnish. Experiments were made about 1,300 to 1,400 m. off the Cape of Mont Boron, at Villefranche, in the Gulf of Nice, and in water about 550 m. deep. During April the limit of penetration of the daylight about midday during fine weather was found to be about 400 m.; an observation which confirms the previous conclusions of the authors as given in our columns. Other observations showed that there is a penetration of 300 m. all the time the sun is above the horizon, and of 350 m. during eight hours of the day. According to experiments of Bunsen and Roscoe the active intensity of blue sky on April 21st at Vienna was 33 at 8.30 a. m., 38 at noon, and 14 at 6 p. m., while that of the sky and sun together was 75 at 8.30 a. m., 133 at noon and 15 at 6 p. m.

Brickmakers' Convention.

(*Continued from page 215.*)

Material," by J. J. Bussie of Covington, Ky., was read by title only.

A vote of thanks was tendered to all parties that had extended any courtesies to the convention.

The motion was made that the "Children of Israel," who were engaged in brick making in Egypt—which fact was occasionally mentioned during the sessions be made honorary members of the Association.

All business before the convention having been finished, the session adjourned, after appointing an Executive Committee, with power to act during the intervals between regular sessions; and empowering them to select the next place of holding the annual session.

Members of Brick Manufacturers Association.

The following comprises the list of delegates present at the two day's conference and who comprise the association at present:

D. V. Purington, 161 La Salle street, Chicago; J. M. Billingsley, Indianapolis; R. B. Morrison, Oakdale, Ga.; J. C. Adams, Indianapolis; B. W. Blair, Cincinnati; J. W. Penfield & Son, Willoughby O.; E. A. McGintie, 161 La Salle street, Chicago; G. N. Sherer, Terre Haute; G. F. Ballou, Canandaigua, N. Y.; J. A. Blaffner, New Orleans, La.; Cyrus Chambers, Philadelphia; A. J. Weckler, 1,279 Clybourn avenue, Chicago; Lindley Vinton, Indianapolis; W. S. Kolin, Richmond, W. Va.; F. C. Frey, Bucyrus, O.; J. M. Burkhart, Marion, O.; John M. Blair & Sons, Cincinnati; A. O. Jones & Co., Columbus, O.; Standard Brick Company, Aurora, Ind.; C. J. Holman & Co., Sargent Bluff, Ia.; Fletcher & Thomas, Indianapolis; John Walker, Aurora, Ind.; Henry Martin, Lancaster, Pa.; Sutton Brick and Tile Company, Urbana, Ill.; Chattahoochee Brick Company, of Atlanta, Georgia; C. W. Campbell, Paris, Tenn.; Wallis & Hollis, Canandaigua, N. Y.; B. L. Holl, Montgomery, Ala.; L. A. Charles, Lexington, Ky.; Isaac De Forest & Son, Sharon, Pa.; W. R. Cunningham, Frankfort, Ind.; J. G. Wagner, Covington, O.; R. B. Wilson, Cincinnati; Martin Itter, Omaha, Neb.; John Itter, York, Neb.; Itner Bros., St. Louis; H. Livesey, Omaha, Neb.; E. B. Hall, Toledo, O.; J. P. Guinness, Hancock, Mich.; J. R. Laws, Lexington, Ky., George E. Noyes, Washington, D. C.; P. B. Watkinson & Son, St. Louis; W. D. Gates, Terra Cotta, Ill.; W. L. Grant, Goldsboro, N. C.; T. A Randall & Co., Indianapolis; J. J. W. Billingsley Indianapolis; Adrian Brick and Tile Company, Adrian Mich.; J. R. Mantle, Vincennes, Ind.; Jos. Budd, Rockland, O.; O'Gorman Bros., Ottawa, Ill.; J. R. Kemp, Youngstown, O.; L. P. Dodge, Montgomery, Ala.; Nolan, Maddern & Co., Rushville, Ind.; Prof. R. T. Brown, Indianapolis; J. A. Close, Woodstock, Ont.; J. E. Conger, New Albany, Ind.; Frank M, Wheeler, Richmond, Ind.; J. H. Barker, Cincinnati; J. D Caldwell, Menominee Wis.; E. A. Hersberg, Milwaukee; McK. M. A. Sprague, Gallipolis, O.; Chas. W. Raymond, Dayton: Root & Frey, Wilkesbarre, Pa.; Pullman Brick Works, 32 189 La Salle street, Chicago; Tiffany Pressed Brick Co., 42-175 Dearborn street, Chicago; F. A. Randall, Clay Workers, Indianapolis, Ind.; Edward Brockway, Haverstraw, N. Y.; Chicago Anderson Pressed Brick Co., 137 La Salle street; Illinois Pressed Brick Co 161 La Salle street; Lockwood & Kimball, 162 East Washington street, Chicago, Ill. E.

The Cincinnati Industrial Exposition.

Reported for Engineering News.

Cincinnati, Sept. 24, 1886.

The Thirteenth Annual Industrial Exposition is attracting many visitors this year, as it is considered to be one of the best that has been held. All departments are very complete, and there is a fine display of all kinds of commodities.

One of the most interesting exhibits is that of clay working machinery. Chambers Bro. & Co, Fifty-second street, Philadelphia, make a fine showing of their various brick making devices, artificial dryers, etc. Messrs. Fletcher & Thomas; C. & A. Potts & Co. of Indianapolis; George E. Noyes, Georgetown, D. C.; the Adrian Brick and Tile Machine Co., Adrian, Mich.; Jonathan Creager's Sons, Cincinnati; Frey, Sheckler & Hoover, Bucyrus, Ohio; J. W. Penfield & Son, Willoughby, Ohio; C. W. Raymond, Dayton, Ohio; D. J. C. Arnold, New London, Ohio; the Anderson Foundry & Machine Co., Anderson, Ind.; the Southern Ohio Brick and Terra-cotta Co.,

Cincinnati, Ohio, all have fine displays of machinery, which is in operation, showing the different processes of brick manufacture, proving very instructive as well as interesting.

There is also a complete exhibit of other kinds of machinery in the large space devoted to that purpose. The Lane & Bodley Co., Cincinnati, Ohio, show one of their handsome Corliss engines, with a number of other machines of their own make. Gordon & Maxwell, steam pump machinery, Hamilton, Ohio; National Water Tube Boiler Co., New Brunswick, N. J.; Baldridge & Hogan, 7 & 9 Vine street, Cincinnati; Union Stone Co., Boston, Mass., Manufacturers of emery wheels, etc.; E. D. Shays & Co.; railway machinists' & miner's supplies, 116 West Second street, Cincinnati, Ohio; Reading Iron Works, wrought-iron pipes, Philadelphia, Pa.; Richmond Machine Works, Richmond, Ind.; Ahrens Manufacturing Co., Cincinnati, Ohio; Silvey Electric Light & Motor Co., 116 Main street, Cincinnati, Ohio; J. J. Watrous, engines and foot power machinery, 213 Race street, Cincinnati, and Smith, Myers & Schnier, saw mill machinery, Cincinnati, are especially worthy of mention for their admirable displays of machinery in their respective lines.

One of the most attractive places to the visitor is the superb Music Hall, with its colossal organ, beautiful exhibits of textile fabrics, art gallery, fine art department, and Japanese village. To the lover of good music here may be heard every afternoon and evening one of the best orchestras in the country, led by Michael Brand. The programmes are arranged to meet all tastes, and are excellently rendered.

Cincinnati probably takes the lead in the matter of industrial expositions, which do not seem to be made as much of an advertising medium as in some of the other cities. There is evidence of more culture, better management, less haste in arranging, and greater artistic display than in some expositions, all reflecting a high degree of credit on Cincinnati as a great industrial and art center. E.

Cryptography.

The System of Julius Cæsar. This is simply the inversion of the letters of the alphabet. The system is very old and is said to have been used by the Phoenicians and Carthagenians. Augustus employed it in writing to his children, and Julius Cæsar, in corresponding with his friends, made use of an alphabet where each letter was advanced four places.

The system consisted in inverting the letters of the ordinary alphabet, according to an order previously agreed upon as a key, and then in replacing each letter of the text proper by the letter which corresponds to it in the inverted alphabet.

The most simple key that can be used is to replace each letter by the one which occupies the next place in the common alphabet. Thus, for example, to write the sentence,

The enemy advances,

we have a cryptogram like the following:

uif fofnz bewbodft.

We can, however, employ a literal key which can be used as a numerical formula in inverting the alphabet. Taking, for example, the key word *Orleans*, we will have:—

O r l e a n s
5 6 3 2 1 4 7
e f c b a d g
m j i h k n
s t q p o r u
y x v z

and the inverted alphabet will be:—

Alphabet { inverted *e f c b a d g l m i*
{ normal *A B C D E F G H I J*
j h k n s t q p o r u y x v z
K L M N O P Q R S T U V X Y Z

We will now replace each letter of the ordinary alphabet by that which occupies a similar place in the inverted alphabet; and for the sentence

Concentrate your forces

we would write:—

CSNCANRERA VSUP DSPCAO.

Or, we can simply arrange the normal alphabet in two rows, and in writing a sentence use the letter above or below the normal letter. Thus:—

a b c d e f g h i j k l m
n o p q r s t u v w x y z.

Text proper; *Come tomorrow*
Cypher text; *pbzr gezbeebj.*

The Saint-Cyr System. This system taught for years at the School of Saint-Cyr is very easy, for it is simply the variation of a square number. It is used as follows:—

Take two bands of paper, trace upon the first an ordinary alphabet, called the *fixed alphabet*, and upon the second a double alphabet, called the *moveable alphabet*, and in using them slide one past the other.

A B C D
a b c d

The letters of each of these alphabetical strips should be arranged in squares of an equal size; then to use it choose a key word, taking *Fire* for example. This word has four letters, and the text to be written must be arranged in groups of four letters each. If we would write the sentence in cypher: *What can you do?* we would have as divided:—

What cany oudo,

Then, number the first letters of each group, then the second and the third and fourth. To find the cypher for the first letters, we place the first letter of the key *f* of the moveable alphabet under the letter *A* of the fixed alphabet, and we extract the first letters of each group as found in the fixed alphabet by taking the letter under it in the moveable alphabet. The second letter of the key is *i* which must be then put under the *A* of the fixed alphabet and the second letter of each group then found as before. By doing this with the four letters of the key we will have:—

W	*h*	*a*	*t*	*c*	*a*	*n*	*y*	*o*	*u*	*d*	*o*
F	*i*	*r*	*e*	*F*	*i*	*r*	*e*	*F*	*i*	*r*	*e*
b	*p*	*r*	*x*	*h*	*i*	*e*	*c*	*t*	*c*	*u*	*s*

which gives the cryptogram:

bprxhiectcus.

While this plan gives great security it is easily deciphered by the expert.—*Le Genie Civil.*

LITERATURE.

The Separate System of Sewerage; its Theory and Construction; By CADY STALEY, President of the Case School of Applied Science, Cleveland, O., and GEORGE S PIERSON, C. E. D. Van Nostrand, publisher, New York, 1886; size, 6x9 inches; pp. 183. Price, $2.50.

This is without doubt the most complete treatise on the separate system of sewerage yet published; and aside from original matter gathers together between single covers information that is now widely scattered in pamphlets and other practically inaccessible documents. After treating of sewers as a general necessity, the authors contrast the separate and combined systems; and as the strongest argument to the average citizen, put down the cost of the first as being from one-eighth to one-third that of the combined system as deduced from actual experience. The following portions of the work relate to the plans for a separate system, discussing the capacity required, quantity of sewage and water, law of flow in sewers and methods of gauging, and the materials and accessories of construction. Under this latter head come very clear illustrations of practice; and the various flush-tanks and methods of ventilation are also pictured and described. A very useful feature of this book is the giving of numerous tables of cost from work actually done, and the construction, form of notes, forms of contracts and specifications, inspection of material, etc. The closing chapter is devoted to house drainage and plumbing.

Journal of the Association of Engineering Societies, August, 1886.

CONTENTS:—"Kutter's Formla and its application to Circular Sewers," by ROBERT MOORE and JULIUS BAIER. "A Design for a Stadia Rod," by G. A. M. LILIENCRANTZ. "Memoir of Edward B. Talcott," by WILLARD S. POPE. "Notes on the Panama Canal," by CHARLES D. JAMESON.

A Manual of Lithology. By EDWARD H. WILLIAMS, Jr., E. M. Professor of Mining Engineering and Geology, Lehigh University, So. Bethlehem, Pa., John Wiley & Sons, publishers, New York, 1886; 3¾ × 5¾-inch pp. 135; Price, $1.25.

A useful little book; of slight bulk, and well adapted to the needs of the civil engineer who should be familiar with the various rocks he encounters. It is very practical in its treatment of the subject; being a brief description of the principal rocks, and it furnishes a ready method for their determination.

Directory of the Iron and Steel Works of the United States. Embracing blast furnaces, rolling mills, steel works, forges and bloomaries in every state and territory: also, lists of wire mills, wire-nail mills, car-axle works and car-wheel works, car-builders, locomotive works, wrought-iron pipe works and cast-iron pipe works. Prepared and published by the American Iron and Steel Association. Corrected to July 15, 1886. No. 261 South Fourth street, Philadelphia, Pa.; size 6x8½ inches, pp. 207. Price $3.00.

This is the Eighth Edition of the Directory and embraces many new features not in the preceding one of 1884. The preface and summary have already furnished material for comment in this journal and is the best resume of the present condition of our iron and steel industries extant. A well arranged index renders the useful contracts of this book very accessible.

WATER

PLAINFIELD, N. J.—It is safe to assume that this most delightful suburb of New York, is pledged to a system of water supply and sewerage. At a special meeting held last week the members of the Council present expressed themselves decidedly in favor of such a scheme and the council may be considered a unit in opinion on the subject. Engineer Bassett, of Newark, will probably be engaged to make surveys, and Rudolph Hering, of Chicago, will be consulting engineer. The city has a population of 13,000, mostly of well-to-do people, and a large proportion decidedly wealthy New York business men. There is small chance of the city undertaking the work itself on account of the conservative spirit of its majority vote. The city is out of debt; everything is most favorable for the construction of the works, and the field is open to the franchise hunters.

BASIN 3, SUDBURY RIVER IMPROVEMENT OF THE BOSTON WATER SUPPLY. In 1882, the growth of *spongilla* on the Farm pond, one of the Sudbury river basins, brought about appropriations from Boston City Councils for improving the four basins. It was recommended that the shallow flowage in Basins 2 and 3 be removed by deepening the marginal waters, and $80,000 was appropriated for work on Basin 2, and $125,000 for Basin 3. Work was completed on Basin 2 in 1883; and work was commenced on Basin 3 in April of this year, and is now finished. This basin is about 2¼ miles long, and the shore is very irregular with shallow bays. A portion of the work of deepening these bays has been done by day's labor, and the great part was let by contract at from 22½ to 31 cents per cubic yard. About 215,000 cubic yards have been removed by contract between high-water mark and a line 10 feet below. The total excavation was about 300,000 cubic yards; and the general plan was to remove the loam and muck and deposit it along the margins of the basin with a heavy layer of gravel next to the water. About 10,000 stumps were also taken out from the basin. The importance to the greater purity of the Boston water supply by the work done upon these basins can hardly be estimated. The work has been done under the immediate direction of Mr. Desmond Fitzgerald, the resident engineer of that section of the Boston Water-Works.

THE Mason Regulator Co., of Boston, in addition to their regular line of steam regulating appliances, have commenced the manufacture of a line of small globe

valves, the principal feature of which is claimed to be superiority in stock and workmanship. They will be happy to send quotations.

BLACKMER & POST, ST. LOUIS.—The requirements of the trade of this enterprising firm making continuous night work necessary, they have just put an Edison incandescent electric light plant in their works, with forty burners. The light is in operation, and gives excellent results.

PALMER, MASS.—The Knox Hill Water Company has chosen the following officers: President, W. A. Winter: Vice President, Charles Holbrook; Clerk, A. E. Park: Directors, W. A. Winter, W. H. Hitchcock, Charles Holbrook, A. E. Park and George W. Ely. The corporation has awarded the contract for the construction of the new reservoir to George A. Griffin, the size being 20 feet long, 10 feet wide and 15 feet deep.

NEWS OF THE WEEK.

Contracting.

[SPECIAL TELEGRAM.]

CHICAGO, October 1st.

ENGINEERING NEWS

Contracts for grading, etc., the Chicago, Madison & Northern R. R. from Freeport, Ill., east seventy-six miles to Fox river, will be opened and awarded by the Illinois Central R. R. Co., on October 14th.

Dredging.—The following proposals for dredging in the Schuylkill river, Pennsylvania, have been received by Lieutenant Colonel Henry M. Robert. P. Sanford Ross, Jersey City, N. J., 25 cents per cubic yard; Richard M. Payn, Albany, N. Y., 19.9 cents; National Dredging Company, Wilmington, Del., 24 cents; American Dredging Company, Philadelphia, Pa., 19 cents; Frank C. Somers, Philadelphia, Pa., 23.5 cents.

The following bids have been received for dredging in the Delaware river, west of Petty's island: Frank C. Somers, Philadelphia, Pa., 39.5 cents; American Dredging Company, Philadelphia, Pa., 32 cents.

The bid of the American Dredging Company was recommended for acceptance in both cases.

The Boundary Sewer of Washington, D. C.—This sewer, one of the largest in diameter in the world, is about completed after seven years work, and the expenditure of $650,000. The first section is 3600 feet long, and 9 feet 9 inches high by 6 feet 6 inches wide; it is made up of a single circle of lining brick on upper half and double brick and trap-rock invert, incased in 12 inches of concrete on upper half, and 17 inches below. The second section is circular, and 10 feet in diameter, with same lining as above, and 15 inches of concrete. The third section is 17¼ feet high, and 15 feet wide, built like the first section. Then comes a circular section 20 feet in diameter; this has a double row of lining brick and a trap-rock bottom, with a single lining row above; it is cased in concrete 43 inches thick at the sides, with 22 inches on top, and 24 inches in the bottom. The last section is 2,200 feet long, and 22 feet high by 20 feet wide. This sewer was all built in open trench, which was in places 55 feet deep by 40 feet wide.

Garbage Disposal.—City Works Commissioner Connor and Health Commissioner Otterson, of Brooklyn, have opened and announced proposals for the collection and disposition of the garbage of the city. The Commissioners called for proposals for a term not to exceed five years, and separate proposals for the months of October, November and December of this year. The appropriation for the work next year is $50,000. The appropriation for this year, $30,000, was long ago exhausted, and the city is doing the work at the rate of $60 000 a year, taking the money from the revenue fund, under the emergency provision of the charter. Mr. George F. Swift threw up his contract in the summer of 1885, and City Works employés have since been collecting the garbage and delivering it to J. F. Sias, who railroads it out to Yaphank, L. I. The service within the city has been very imperfect. There were nine bids received for the five years term, the lowest being that of Daniel Gallagher for $212,000, and the highest that of Seth L. Keeney for $75,000 or $375,000 in all. The other bidders were J. P. Cranford, $330,000; Robert Furey, $341,000; George F. Swift, $250,000; John H. O'Rorke, $233,000; Henry Berau (the street cleaning contractor) $273,000; Hugh S. Blake, $310,000, and John Anderson, $280,000. For the remaining three months of the current year seven bids were received: Daniel Gallagher, George F. Swift and John H. O'Rorke proposed to do the work for $15,000 each; Henry Berean for $17,000; H. S. Blake and John Anderson for $18,000 each, and S. L. Keeney for $20,000.

Railroads, Bridges and Canals.

Sheffield & Birmingham (Ala.) R. R.—There are twenty-five miles of the S. & B. R. R., now under contract to be finished by June 1st, 1887. Walter Wilson has the contract for the first four miles, beginning at the end of the old grade three and one-half miles south of Russellville and extending to the top of the mountain. Mr. Eaton, of Cincinnati, has the contract for the next twenty-one miles. Mr. A. M. Shook is president of the Construction Co.; P. Campbell is Superintendant of Construction and A. Mitchell is Chief Engineer. The location is now made to the Byler Ridge and will soon be completed. This road will be of great benefit to Sheffield in developing the iron ore and coal south of Russellville and two iron furnaces are now being built in Sheffield in consequence.

Abstract of Proposals for Building Dam and Abutment of Lock No. 2., Great Kanawha River Improvement, Opened 12 M., September 24.

	Estimated Quantities.	No. 1. Louis M. Petitdidier, Cincinnati, Ohio.		No. 2. Water and Gas Works Construction Co., Pittsburg, Pa.		No. 3. McMahon & Walton, Wytheville, Va.		No. 4. C. J. McDonald, Pitts. burg, Pa.		No. 5. Frank Hefright, Huntingdon Pa.		No. 6. Chas H. Strong & Son, Cleveland, Ohio.	
		Price.	Amt.	Price.	Amt.	Price.	Amt.	Price.	Amt.	Price.	Amt.	Price.	Amt.
		$		$		$		$		$		$	
Grubbing and clearing, comp'e			1,500		300		300.00		42 50		500		200
Excavation, per cubic yard	38,000	.75	28,500	1.00	38,000	.88	33,440.00	.85	32,300.00	.60	22,800	.60	22,800
Rock excavation	100	1.50	150	3.00	300	4.00	400 00	2.50	250.00	2.00	200	2.50	250
Embankment in place, per cu. yd.	6,000	.35	2 100	.65	3,900	.50	3,000.00	.50	3,000.00	.50	3 000	.40	2,400
Puddling "	1,000	1.00	1,000	1.35	1,350	1.25	1,250 00	.75	750.00	1.00	1.000	1.50	1,500
Stone filling "	16,000	1.55	24,800	1.75	28,000	1.70	27,200.00	1.75	28,000.00	1.50	24,000	1.75	28,000
Hand placed rip-rap "	550	2.50	1,375	4.00	2,200	3.00	1,650.00	2.25	1,237.50	5.00	2.750	4.00	2,200
Paving "	630	4.00	2,520	6.50	4,095	4.00	2,520.00	4.50	2,835.00	6.00	3,780	5.00	3,150
Rock faced masonry "	950	9.50	9,025	12.00	11,400	10.25	9,737.50	12.50	11,875.00	10.00	9 500	8.50	8,075
Coping "	32	16.00	512	25.00	800	25.00	800.00	17.50	560.00	25.00	800	20.00	640
Timber in place, per 1,000 ft. B.M.	1,070,000	30.00	32,100	39.50	42,265	33.95	42,746.50	35.00	37,450.00	50,00	53,500	39.00	41,730
Iron per pound	51,000	.05	2,550	.10	5,100	.05	2,550.00	.05	2,550.00	.10	5,100	.05	2,550
Total			$106,132		$137,610		$125,594 00		$120,850 00		$126, 930		$113,405

Keeping up a Section Successfully a Trade.—A foreman writing to us encloses his subscription and says that he is glad to assist a paper published in the interests of his profession. While it is not generally accounted thus, at the same time it is true that to maintain four, six or seven miles of railway successfully and in good condition, requires a foreman to understand the business in a thorough and intelligent manner that places the position of a section foreman upon a level with any branch of railway service. On him, to a large extent, depends the profitable success and reputation of a road. Without a good road-bed, nicely lined and level jointed track, it is next to impossible for a train to make good time. W. B. Parsons, the eminent author of a volume entitled "Track," says that at points where there are several lines of railway, and a large amount of passenger traffic carried, that he has known people who were entirely ignorant of track work to choose competing lines to reach points, on account of the tracks apparently good condition. The weeds being cut, ties nicely spaced and the track being in good line. This goes to show that a well maintained track has a large influence with the public as well as a convenience to the company.

A Section Foreman that studies the best way to keep up his section and the most economical plan, is sure to be appreciated by his employers. The time has now arrived where railway track service demands competent and intelligent men. An enterprising foreman one who takes pains to thoroughly post himself in regards to the latest methods of the maintenance of track, is sure to get to the front, and to be appreciated by the road master. They should read books regarding the maintenance of track, and get new ideas, etc. The fact that there are various ways and methods of performing track work. The time is past when a foreman can follow old stereotyped rules for keeping up his section. He must be alive to new varieties of work and improved methods. When you have learned new ideas, do not be too chary, or afraid of letting others know of them. If you have confidence that your way is right, and an improvement on old methods, let others know it. By doing you will be a benefit to the profession, and besides having the credit of being an energetic foreman. Were all foremen to do this the track fraternity would be greatly benefitted.—*Railway Section Foreman.*

Glass Railroad Sleepers.—Mr. Siemens writes from Dresden:—"As concerns the report mentioned in several English papers about the discovery of producing rails in the same way as sleepers, I must state that the contents of this report are founded on a misunderstanding. German newspapers, which brought their articles regarding cast glass translated from English journals, erroneously translated the English 'sleeper' into the German 'schienen,' signifying 'rails' in English, and it was this mistake which led the English papers to the opinion that Mr. Frederick Siemens had succeeded in manufacturing also rails from cast glass. Allow me to add for public information that a sample of these glass sleepers recently tested at the Anderston Foundry Company, Limited, Glasgow, resisted a falling weight of 3¼ cwt. falling upon a rail placed upon the sleeper set in sand ballast, commencing at 6 inches and rising by succeeding increments of 6 inches up to 9 feet 6 inches—the maximum elevation to which the test ram could be elevated—without effects until the blow had been repeated for the sixth time. Cast iron sleepers are expected to withstand a similar test up to 7 feet only. The cost of glass sleepers will be considerably less than those of either cast iron or steel, while the material is practically imperishable as regards climatic changes, atmospheric influences, or the ravages of such insects as the white ant."

Lengths of English Tunnels.

Name.	Company.	Yards.
Severn	Great Western	7,664
Stanebridge	Northwestern	5,342
Woodhead	Manchester & Sheffield	5,297
Bramhope	North-Eastern	3,745
Medway	South-Eastern	3,740
Sevenoaks	" "	3,600
Box	Great Western	3,227
Litt eborough	Lancashire & Yorkshire	2,869
Sapperton	Great Western	2,800
Polehill	South-Eastern	2,750
Mersey	Mersey Railway	2,700
Kilsby	London & North Western	2,423
Dove's Hole	Midland	2,420
Shepherd's Well	Chatham & Dover	2,376
Wapping (Liverpool)	London & North Western	2,250
Lime street "	" "	2,230
Clayton	London & Brighton	2,200
Sydenham	Chatham & Dover	2,190
Abbott's Cliff	South-Eastern	2,000

The Poughkeepsie Bridge.—Work has actively begun on the construction of the Poughkeepsie bridge. The contract for the masonry of the piers has been let to Dawson, Symmes & Usher, of Buffalo, N. Y., and the contractors began their operations on Monday. They built the masonry for a large bridge across the St. Croix river for the Union Bridge Company, and have just completed a very heavy contract upon a railroad in Canada. The plant left by the American Bridge Company has been turned over to them and they are putting it into shape for service. As soon as this is done they will set their men at work taking down the stone work on the pier near the west shore and rebuilding it. Meantime the work on the other pier will be begun, and advanced as fast as possible. It is hoped to get the foundation ready for one span of the bridge itself before winter. The Union Bridge Company, which is to furnish the superstructure, has thus far been engaged in examining thoroughly all the old work on the foundations of the bridge, ascertaining its exact condition, and just what is necessary to be done to make their new work and somewhat changed plans fit upon it. For this purpose they have employed Charles B. Bush, who is an expert in submarine engineering, having recently made the borings for the new Harlem bridge. Mr. Bush has for some time been engaged with a large gang of men boring into the material placed under water, into two piers that have been begun, and also into the river bottom to ascertain the nature of the the strata, and the depth at which solid foundation can be found. The present contractors prefer to take their own surveys instead of any which have preceded. It may be added that the conviction that the Central Massachusetts R. R. is to have an extension to the Poughkeepsie bridge is growing. The engineers and contractors have finished boring and sounding about the two piers already in the river, and have begun the work of locating the third.

Contractors Intelligence,

Reported by T. H. Boorman.

Engineering and Building Materials.

WHOLESALE PRICES.

New York, September 30, 1886.

IRON.

STRUCTURAL IRON.			
Angles		2.00c	@ 2.20c
" steel		2.40	@ 2.50
Tees		2.50	@ 2.60
Beams and channels, American		3.0	@
Tank plates		2 20	@ 2.25
Shell plates		2.50	@ 2.60
Steel plates, Tank		2.70	@ 2.75
WROUGHT-IRON PIPE. PITTSBURG.			
Butt welded, black	Discount		42½
" galvanized	"		32½
Lap welded, black	"		55
" galvanized	"		37½
Boiler tubes	"		47½
RAILS.			
Steel (large lots at mill)		$34.00 @	$36.00
Old rails		21.50 @	22.50
Old rails, steel		22.00 @	23.00
R R. spikes		2.15c @	2.25c
R R. splice-plates		1.85 @	1.90
R R. track bolts, square nuts		2.50 @	2.75
Barb-wire fencing, galvanized		3.85 @	3.95
" painted			4.00
Corrugated iron			
Nails			
Iron, per keg		2.00 @	2.10
Steel do.		2.10 @	2.20

METALS.

COPPER.		
Lake Superior	11.00	
Other Brands	11.05 @	11.45
LEAD.		
Com. Domestic	4.50	
Lead Pipe	.06½c.	
Tin-Lined Lead Pipe	.15	
Sheet Lead	.07¼	
ZINC.		
Sheet	5.60 @	5.70

BRICK.

Cargoes (afloat)			
Choice Brands		7.25	
Haverstraw	per M.	6.50 @	7.25
Fishkill		6.50 @	6.62½
Up-River		5.50 @	6.25
Jerseys		5.75 @	6.25
Long Island			
Pale		4.50 @	4.75
FRONTS.			
Croton, red		11.00 @	15.00
" dark		11.00 @	15.00
" brown		10.00 @	14.00
Philadelphia pressed		27.00 @	28.00
Trenton "		25.00 @	26.00
Baltimore "		37.00 @	41.00
Buff "		33.00 @	35.00
Enameled English		85.00 @	130.00
" American		80.00 @	120.00
Fire brick		25 00 @	55.00
" American, No. 1		30.00 @	35.00
" " No. 2		25.00 @	30.00

ASPHALT.

ROCK.		
French, per ton	$20.00 @	25.00
German	15.00 @	20.00
According to quantity or brand, and whether taken from vessel or store.		
PAVEMENT.		
Barber's Asphalt	$2.50 @	$3.00

LIME.

Rocklock Cement Co.'s Ground	.80
Rockland, common per bbl	1.00
" finishing	1.20
State, common	.85
" finishing	1.05
Kingston, ground	.90
Add 25c. to above figures for yard rates.	

STONE.

Cargo rates at New York.

Amherst freestone,	No. 1 per cub. ft.	0.95 @	1.00
" "	No. 2 "	0.75 @	0.85
" "	light drab "	0.80 @	0.95
Berlin "	in rough "	0.75 @	1.00
Berea "	" "		
Brown stone, Portland, Ct.	"	1.00 @	1.35
" Belleville, N. J.	"	0.75 @	1.35
Granite, rough		0.45 @	1.25
Common building stone per load		2.00 @	3.00
se stone, from 2½ to 6 ft. lengths, per lin. ft.		0.40 @	3.00
ncrete and macadam stone, Tomkins Cove, per cub. yd			$1.65

SLATE.

urple roofing	per square	6.00 @ 7.00
Green	"	6.00 @ 7.00
Red	"	15.00
Black Penna. (at New York)	"	4.50 @ 5.00

LUMBER.

Prices for yard delivery in New York.

PINE, Common box	per M.	18.00 @	20.00
Choice		65.00 @	70.00
Tally plank, 1¼ in.10 in. dres'd, each.		.44 @	.50
" " boards, dressed com.	"	.28 @	.30
SPRUCE, Boards dressed	"	.25 @	.28
Plank, 1¼ in	"	.28 @	.30
" 2 in.	"	.38 @	.40
" 2 in. dressed	"	.43 @	.45
Timber	per M.	14.00 @	18.00
HEMLOCK, Boards	each.	.18 @	.20
Joist, 2¼ × 4 to 4 × 6 in		.16 @	.44
OAK	per M.	55.00 @	65.00
CYPRESS 1, 1¼, 2 and 2½ in	"	35.00 @	40.00
YELLOW PINE, Girders	"	25.00 @	30,00
Dressed flooring	"	28.00 @	35.00
SHINGLES, Extra shaved pine, 16in.	"		
" sawed 18 in.	"	5.75 @	6.00
LATH, Cargo rate	"	2.25 @	2.40

PAINT.

Lead, white, American dry per lb		.04¾ @	.06¾
" " " in oil pure		.07 @	.07½
" English, B. B. in oil		.08¼ @	.08¾
" Red, American		.06½ @	.07
Litharge	"	05½ @	.06
Venetian red, American	"	.01 @	.01¼
Indian red	"	.08 @	.10
Vermillion, American lead	"	.10½ @	.11½
Paris green	"	.15 @	.18
Umber, Amer. raw and powdered per lb.		.01¼ @	.01¾
Drop black, Amer.		.07 @	.13
" Eng		.11 @	.13
Chrome green		.10 @	.25
Oxide zinc, American		.03½ @	.03¾
" French		.05½ @	.07½

CEMENT.

The following price current is made up entirely from quotations furnished us directly by the firms dealing in each brand; the prices are understood to be wholesale in New York, subject to such special rates as large quantities may warrant:

CALVIN TOMKINS:			
"Old Newark Co's." Cement			$1.10
BAETJER & MEYERSTEIN:			
Hanover Port.and		$2.60 @	$2.65
BELLONI & Co.:			
Hemmoor "Crown" brand			2.50
JAMES BRAND:			
Burham		2.25 @	2.50
Fewen		2.25 @	2.50
BROOKS, SHOOBRIDGE & Co.		2.45 @	2.60
HOWARD FLEMING:			
Gibbs' English Portland, 400 lbs		2.50 @	2.75
R. B. & S. "		2.25 @	2.50
Stettiner, German		2.65 @	2.85
Lagerdorfer, "		2.45 @	2.75
Fievre, A. 1, Belgian		2.35 @	2.50
Roman		2.75 @	3.00
Keene's Coarse		4.75 @	5.50
" Fine		7.75 @	8.50
" Superfine		8.50 @	10.00
FISHER, ERSKINE W.:			
Stettin (German) Portland Cement		2.40 @	2.75
GABRIEL & SCHALL:			
Vorwohler "Lion"		2.65 @	3.10
HUDSON RIVER CEMENT Co. Rosendale			0
JOHNSON & WILSON:			
Saylor's American Portland		2.15 @	2.45
LESLEY & TRINKLE, Philadelphia, Pa.:			
"Giant" Portland		2.20 @	2.40
Improved "Union"		1.25 @	1.50
Union		1.10 @	1.20
MARCIAL & Co.:			
J. B. White & Bros. Coarse Keene's		4.25 @	4.50
" Superfine		7.25 @	7.50
" Portland		2.65 @	3.00
NEW YORK CEMENT Co.:			
Rosendale			1.10
N. Y. & ROSENDALE CEMENT Co.:			
Rosendale, "Bridge" brand			1.10
SINCLAIR & BAUSON:			
Alsen's Portland Cement Works		2.35 @	2.85
R. B. & S.		2.25 @	2.50
STANDARD CEMENT Co			
E. THIELE:			
Dyckerhoff		2.90 @	3.25
UNITED STATES CEMENT Co.:			
English Portland		2.25 @	2.40
German "		2.00 @	2.15
Standard		1.50 @	1.65
Windsor and Improved Rosendale		1.00 @	1.10
UNION AKRON CEMENT Co.:			
Akron "Star" brand		1.00 @	1.10

MARKET SUMMARY.

The Brick Market is firm and a good business doing at last week's rates. Pales are actively enquired for at $4.50 @ $4.75, choice Haverstraw fetch $7.25 and Fishkill, $6.50 @ $6.62½. The demand for fronts continues good, and there are enquiries for enamelled brick both of home and foreign manufacture. Rosendale cement is in better request, sales are reported at $1.00 @ $1.10 per barrel, with occasional sales of ordinary brands at 95 cents per barrel. Portland cement has arrived very freely, but importers report a good demand, and make no break in prices. The Lumber Market is in a healthy condition with a likelihood of an advance in prices. Spruce Random cannot be bought for less than $14.00 per M., with good schedules selling at $16 00 and extra sizes on order as high as $18.00 per M. Arrivals of Lath during the past week have not amounted to over a million readily placed at $2.25 to $2.30 per M. $2.35 is offered for arrivals and $2.40 asked in some instances. Pine shows no change, and Yellow Pine random cargoes still fetch $18.00 to 19.50 per M.; special cargoes $19.50 to $21.50 per M. West India White Pine shippers $15 00 to 17.00 per M. Lime, Plaster and Hair are unchanged in price with good demand. Paints move in fairly large quantities at previous quotations. Turpentine is about as last week at 37½ cents ex yard, 36½ cents ex store per gallon. Linseed oil has weakened and sales of city have been made at 41 cents per gallon. The demand for Tin plates has been light, but prices have been maintained as there has been no attempt to force the market. Pig Tin has again attracted speculative attention and a lively market reported for future deliveries; demand from consumers has been only moderate. Lead has again weakened for both foreign and domestic, and about 300 tons domestic were sold at $4.50 to $4.45, and 100 tons French at $4.50. The Hardware Market is not active and sales are mainly restricted to actual necessities, jobbers and retailers do not appear to care about stocking up very heavily, and discounts are irregular. Barb Wire is reported as being very unsettled, and figures named of 3.65c. to 3.90c., said to be less than cost of production. Nails in limited request and selling at $2.00 to $2.05 per keg for 10d. to 60d.

BUILDING ITEMS.

Mr. Auguste Namur has drawn plans for a ferry house 138x176 to be erected for the New York and South Brooklyn Ferry and Steam Transportation Co., on piers 2 and 3 East River; cost not yet estimated.

Messrs. Babb Cook & Willard are the architects for the extension and important alterations to be made for Mr. Roswell Smith, to No. 24 East Fifty-first street; cost not yet decided.

Mr. Joseph Ireland has prepared plans for alterations to be made to the Tabernacle Baptist Church on the east side of Second avenue, 50 feet north of Ninth street which will cost about $5,000.

Mr. H. L. Harris is preparing plans for four four-story brick, stone and terra-cotta residences, 20x56 each, to be erected by Mr. Samuel Colcord on West Eighty-first street, at a cost of $140 000.

Mr. F. Carles Merry has prepared plans for a frame cottage to be built at Shinnecock, L. I., for Gen. Swayne at a cost of $10 000.

Mr. J. M. Merrick has designed a two and a half story frame residence, 50x75, to be built for George Bechtel at Stapleton, Staten Island, at a cost of $10,000; also two cottages to cost $7,000 each, to be built at Mount Vernon for Messrs. F. W. Williams and George Reynolds.

The Hebrew Orphan Asylum of Brooklyn, will build a four-story hospital, brick, with stone trimmings, 40x70, on the north side of Decatur street, east of Stuyvesant avenue, to cost about $30 000.

Messrs A. B. Ogden & Son have drawn plans for a five-story brick and stone apartment house, 25ix93.9, to be built on the east side of First avenue, 75 feet south of Seventy-first street, at a cost of $20,000; owner, Mr. Thomas Fitzgerald.

Mr. E. W. Schneider is the architect for a five-story brick, stone and terra-cotta flat, 26x68, to be built for E. Westermayer on the northside of Ninety-eighth street, between Eighth and Ninth avenues, at a cost of about $20,000.

Mr. Jas. E. Ware has designed a five-story brick store, 22.6x68.5, to be erected on the northeast corner of Park Place and Greenwich street, for Mr. S. C. Welch, at a cost of $15,000: Mr. J. P. Niblo is the builder.

Mr. C C. Haight is the architect for a one-story brick and stone ferry house, 52x116, to be erected with sheds, etc., at a cost of $25 000 for the New York & South Brooklyn Ferry Co., at the northwest corner of Second avenue and Thirty-ninth street, Brooklyn.

Messrs. D. and J. Jardine, 1,262 Broadway, report that they have on the boards, plans for a residence of stone, brick and frame, to be built at Yonkers, N. Y., for Mr. Wm. B. Ketcham; cost $15,000

Mr. Jos. M. Dunn, has completed plans and is now engaged on the specifications for a handsome Rectory of the church of the Holy Rosary of which the Revd. Jos. Byron is Rector. It is to be built at No. 444 East One hundred and Nineteenth street, will be three stories high and English basement of stone, above brick stone and terra-cotta, the dimensions are 25x65; cost not yet estimated.

There is a great paucity of news in the architects offices. A good deal of work was to have been started this Fall, but little of it has as yet been placed on the market for estimating, this to a great extent is owing to the strikes among the building trades; the plumbers and stone cutters have stopped all work on many buildings and with the uncertainty as to what extent these vagaries may attain owners naturally do not care to start work, which may have to be abandoned when the walls are partly up, and thus leave property subject to the inclemencies of the winter without roof.

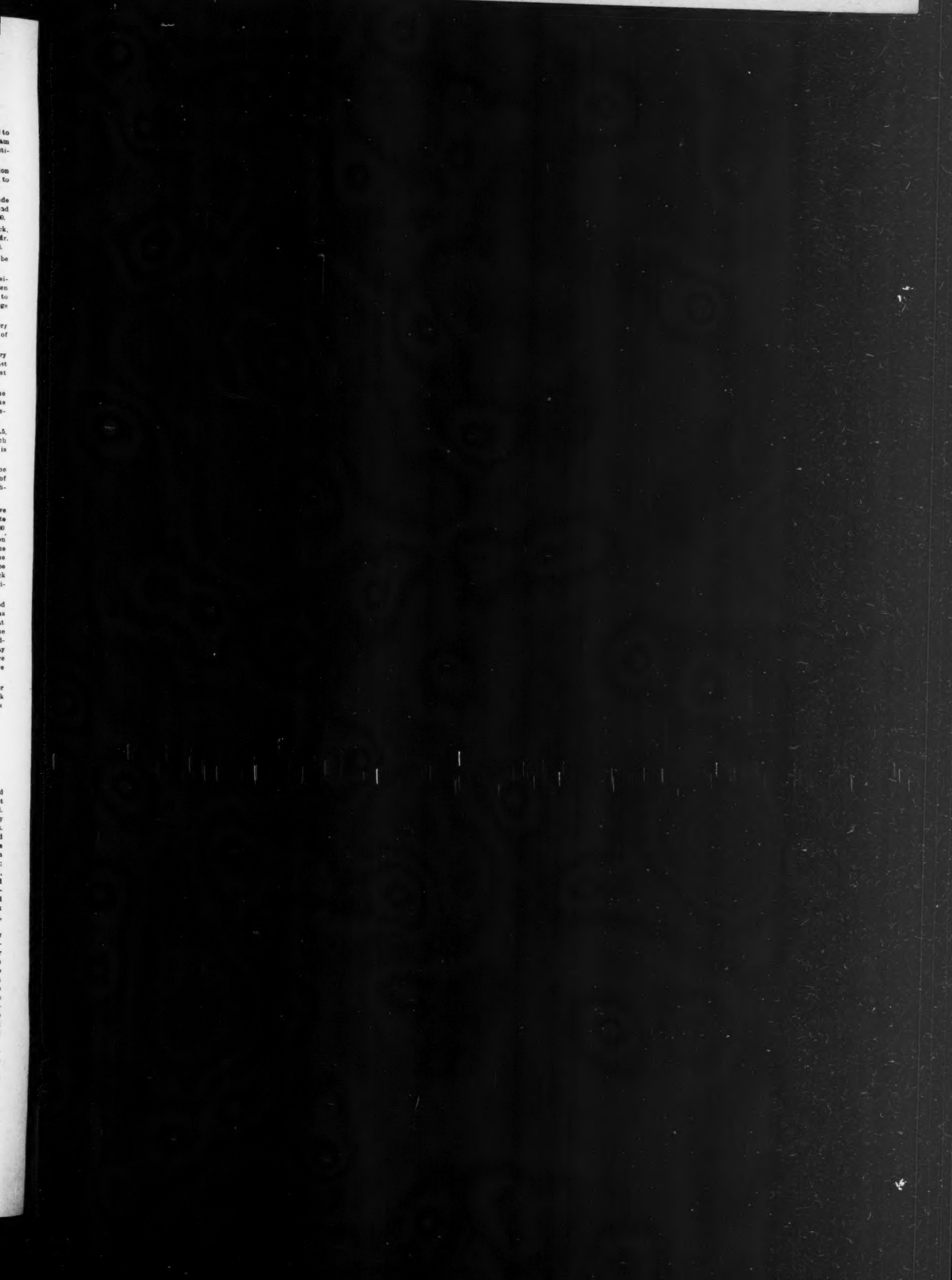
BALTIMORE, MD.—The contract for the erection of the passenger depot of the Maryland Central Railroad on North avenue and Oak street, has been awarded to Messrs. Philip Walsh & Sons Messrs. Baldwin & Pennington are the architects.

TRADE NOTES.

North of England.

(*Iron and Coal Trades Review, Sept.* 10.)

The finished iron trade is very dull yet, and manufacturers find it impracticable to get higher prices from consumers, who want little for early delivery, while they do not care to buy forward. The difficulty of carrying on operations at a profit is illustrated by the reports of some of our leading limited companies. Messrs. Bolckow, Vaughan, and Co., Limited, as we reported last week, did not find it advisable to pay an interim dividend; the Tees-side Iron and Engine Works Company reported a loss on their pig iron business, and their rolling mills have been closed for some years; and now Palmer's Shipbuilding and Iron Company, Limited, which in the year 1884-5 not only paid a good dividend but carried forward as undivided profits £20,000 for the past financial year ending June 30, lost £17,470 on their operations, the loss being incurred during the second half of 1885, the business over the first six months of this year showing a profit. Their new steel works, though in operation only a short time, have yielded a small profit.

As our readers will remember, some months ago Lloyd's Registry refused to allow steel plates made by the Basic process from Cleveland ore to be used in the construction of vessels built under their survey and intended for entry under their registry, the reason being that it was found difficult, if not almost impossible, to ensure the plates manufactured by this process being of uniform quality and strength throughout. This was said to be owing to the unequal distribution of the carbon retained in the steel. We are informed that this difficulty has now been overcome by the substitution of chromium pig iron for the ferro-manganese hitherto used in the Basic process. Chromium pig iron can be produced at a cost not exceeding that of ferro-manganese, and it is expected that a further reduction in its price will be made.

The use of basic steel slag as a manure for agricultural purposes is extending rapidly, and about 1,300 tons per week are sent to Germany and Sweden from the North Eastern Steel Works. It is highly spoken of, the phosphoric acid in basic cinder being much more easily assimilated by plants than the phosphoric acid in ground mineral phosphates, such as coprolites and apatites, and is more nearly akin to precipitated phosphoric acid as regards efficacy. A further report has been received from Dr. Munroe as to the value of the slag manure when applied to garden seeds, and a digest of his report we print in another column.